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RADIO!

Number Five

○ SCANNERS ○ SHORTWAVE • CB • CELLULAR • SATELLITE • HAM RADIO

Fiery Frequencies!

Tracking Down Infernos

Hot Tips For Savvy Scanning

How To Choose The Scanner That's Right For *You*

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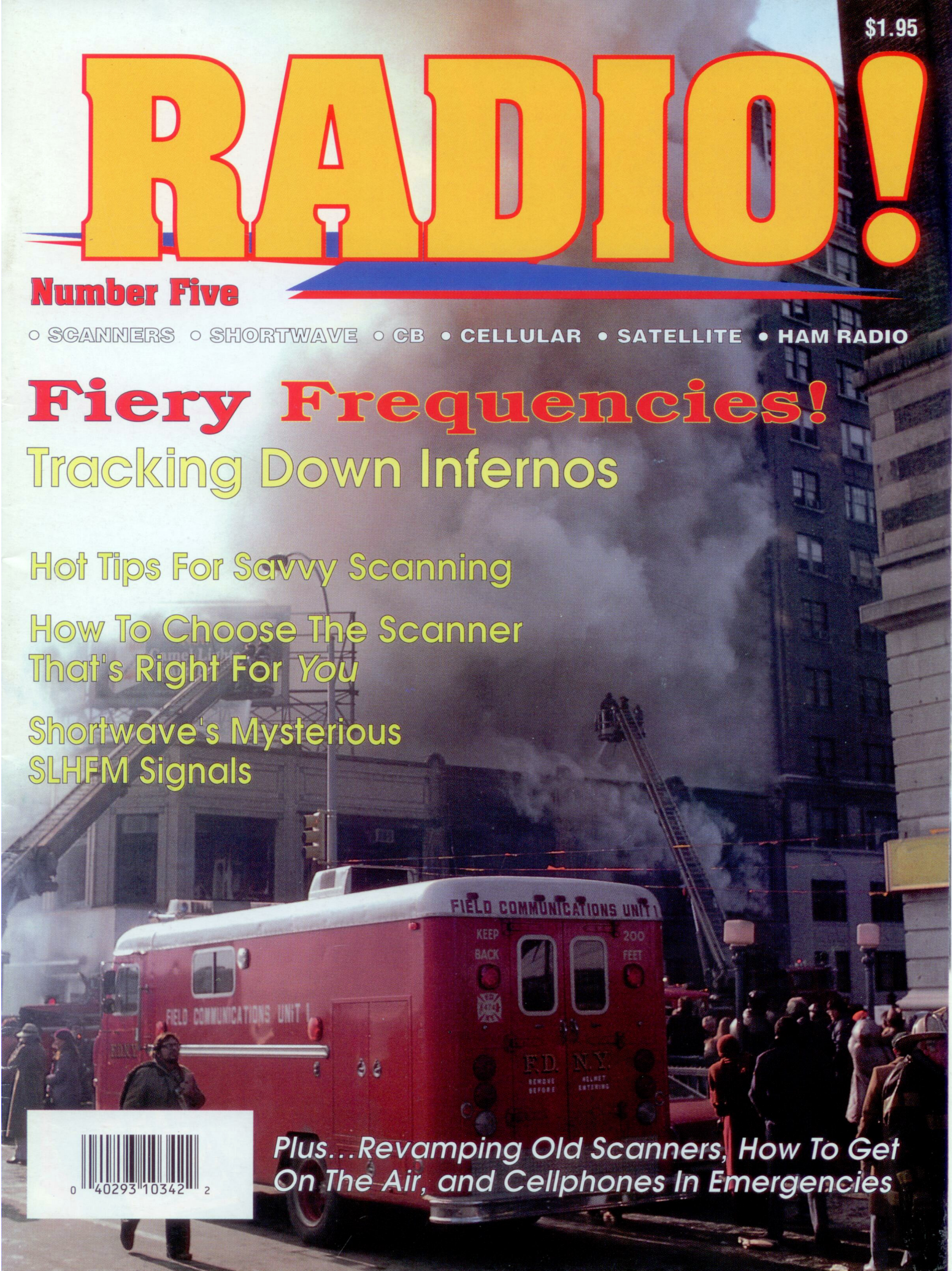

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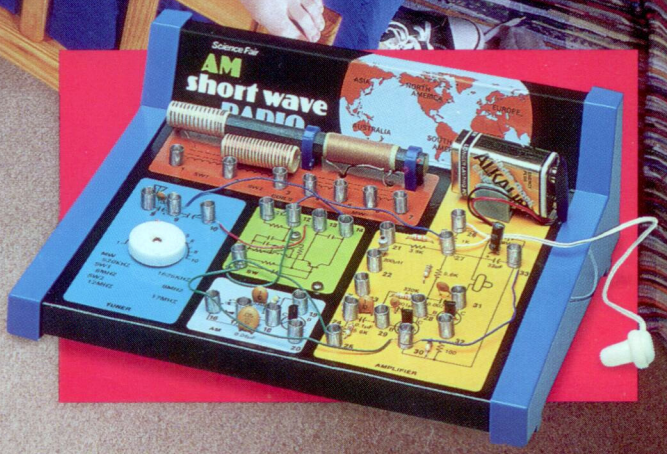

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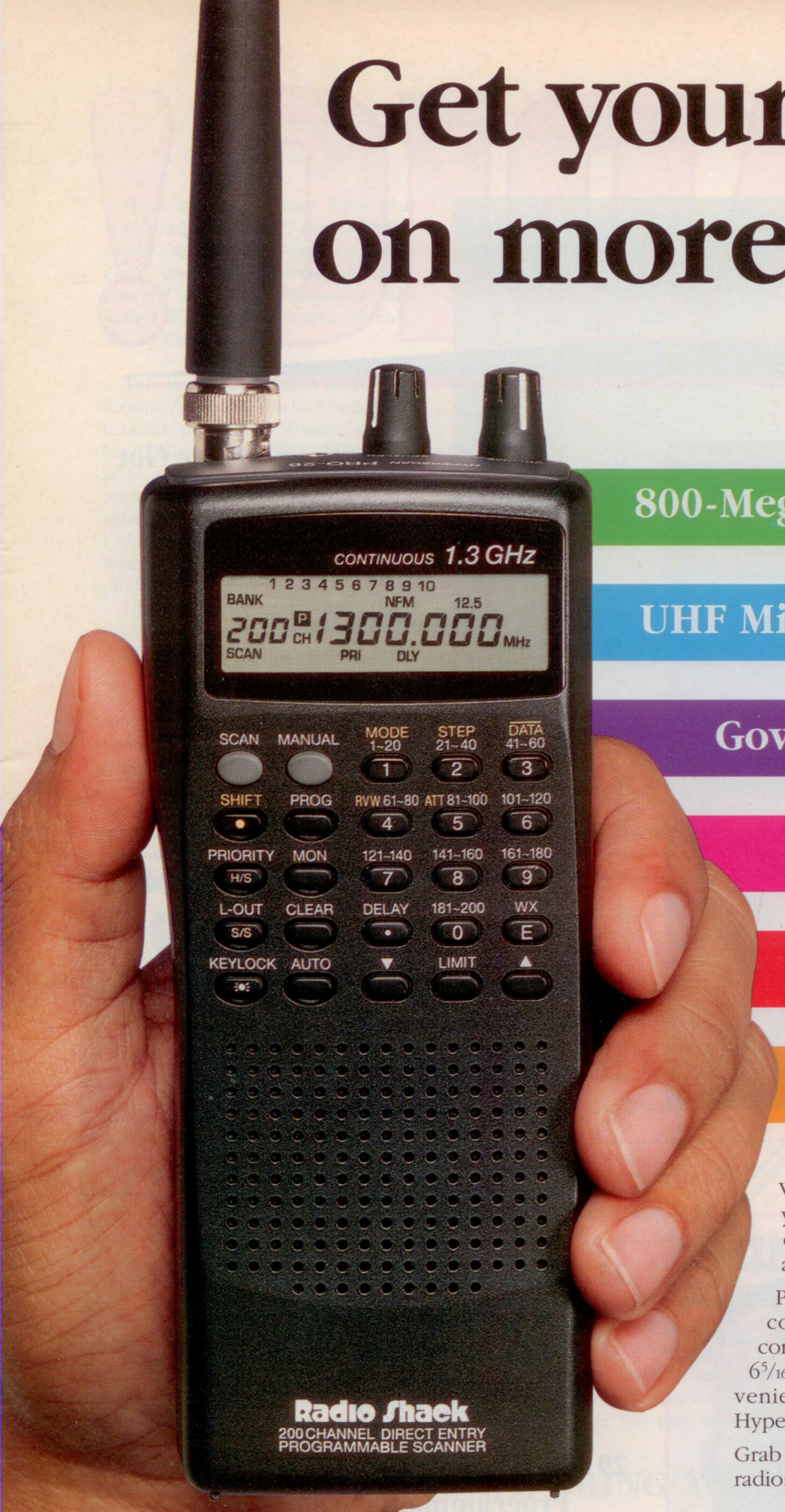

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With RadioShack's hot new PRO-26 scanner, you can monitor local action at home or hear exciting behind-the-scene communications at air shows, car races and sports events.

PRO-26 teams 25-1300 MHz wide band coverage and interference-rejecting triple-conversion circuitry in a rugged housing only $6\frac{5}{16}$" high. And it offers a host of scanning conveniences, including 300-channel-per-second HyperScan™ search and a 200-channel memory.

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RADIO!

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On the Cover: Firefighters of F.D.N.Y. at the scene of a fire. Photo by Larry Mulvehill, WB2ZPI.

This is the year that we celebrate the 100th anniversary of the first wireless transmissions. It is hard to believe that the technology that literally changed the way that we communicate is only 100 years old.

A century ago the only way to converse with people in far away places was to write it down, put it on a ship, and send it away. Thirty days later your message arrived and the reply process started all over again.

Today we have many choices in communications technology and methodology—wired and wireless, analog and digital, FM and AM, LF, HF, VHF, UHF and more. Do a matrix of all the possible combinations and you can see that there are literally hundreds of possibilities.

Think about this for a moment: the first radio station occupied most of a room. Today you can put a state-of-the-art, dual-band transceiver in your shirt pocket.

Many of the products that we take for granted today weren't possible to produce just a few short years ago. The primary limitation on the size of portable two-way radios today is not the circuitry but the size of the controls and batteries. Once we have those problems licked, the scanner that fits in your ear will not be far away.

Since you are reading this magazine, I assume that you have more than a passing interest in the radio hobby. The digital explosion is about to change many aspects of our hobby, and it is almost a full time job keeping tabs on the changes in technology. Radio Shack is committed to leading the market with state-of-the-art radio communications products.

I hope all of you enjoyed the summer and the VHF/UHF tropospheric skip and ducting that I always look forward to. I also hope you're ready for the upcoming holiday season. Don't forget to write a holiday gift list and leave it in a conspicuous place.

73 and Best Wishes

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Vice-President, Radio Shack

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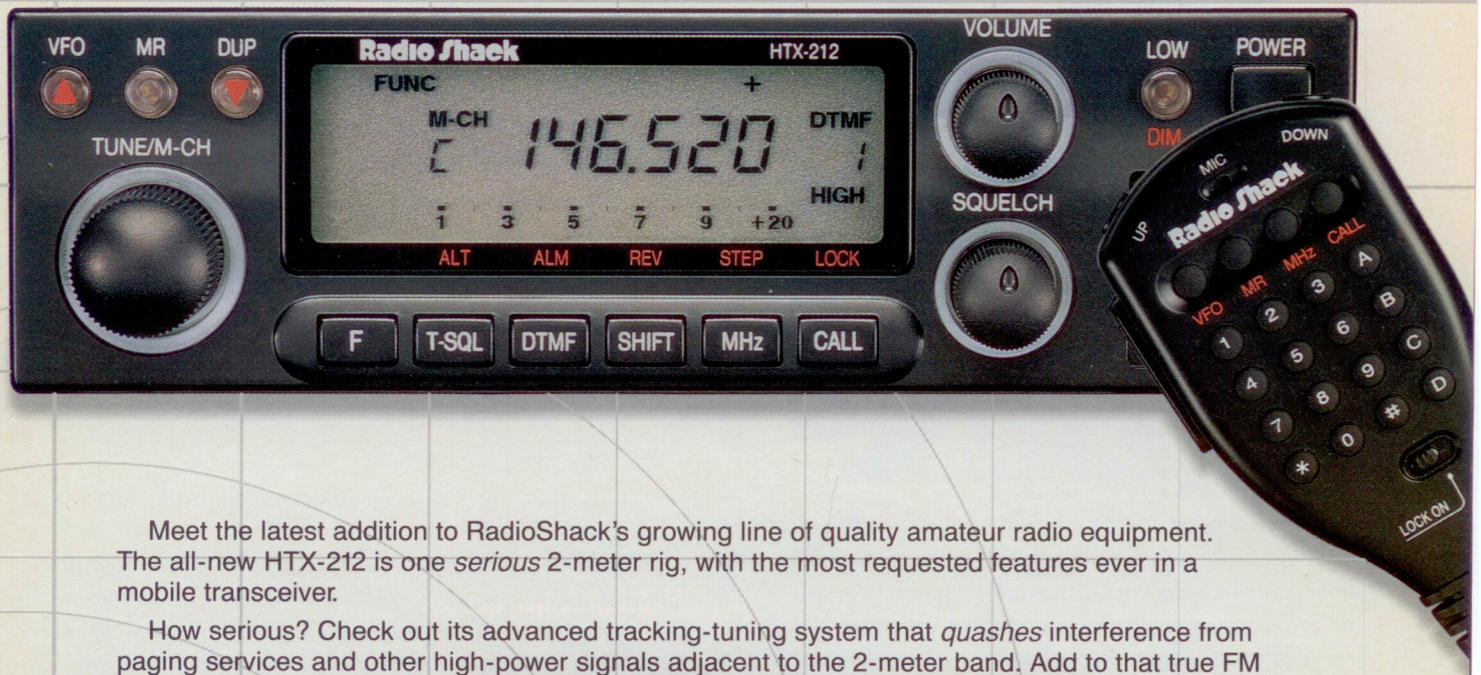
RadioShack 2-meter quality goes mobile!



Meet the latest addition to RadioShack's growing line of quality amateur radio equipment. The all-new HTX-212 is one *serious* 2-meter rig, with the most requested features ever in a mobile transceiver.

How serious? Check out its advanced tracking-tuning system that *quashes* interference from paging services and other high-power signals adjacent to the 2-meter band. Add to that true FM modulation, and you've got clean, natural-sounding audio plus top-notch packet performance.

What's more, you get 30 memory channels and one calling channel, even a priority channel that sounds an alert when active. Programmable repeater offsets. CTCSS encode/decode. DTMF page with group calling. Extended receive from 136-174 MHz, and extended transmit to include MARS and CAP frequencies. Plus selectable 45 or 10-watt power.

Defined *by* U.S. Hams *for* U.S. Hams, with a clear manual *written* by U.S. Hams, the HTX-212 is truly one serious rig. Yet at the remarkably low price of $349.99, it won't cost you serious money! Check it out today at America's first name in radio—your nearby RadioShack.

Transmit Range: 144.600-148.000 MHz (can be expanded with MARS/CAP keyboard modification). **Receive Range:** 136.000-174.000 MHz. **Memory Channels:** 30+1 calling. **Scan Modes:** Band scan, programmed scan. **Power Output (lo/hi):** 10W/45W. **DTMF Memories/Digits:** 6/15. **Programmable Frequency Step:** 5/10/12.5/20/25/50/100 kHz. **Frequency Stability:** ±10 ppm. **Antenna Impedance:** 50 Ohms. **Dimensions:** $1\frac{5}{8} \times 5\frac{9}{16} \times 6\frac{3}{16}$". **Supply Voltage:** 13.8 VDC ±15%

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Q: & A:

You've Got Questions. We've Got Answers.℠

Many readers of Radio! *no doubt have specific questions on some of the subjects we cover in the magazine. This column is for those readers. We'd like to invite you to submit your questions to us, and we'll have our experts answer them in these pages. Recently, several readers asked for clarification of some abbreviations and Gordon West, WB6NOA, replied.*

What is GMDSS? I understand it will affect certain radios by 1999? —Ed Jones, Somerset, New Jersey

GMDSS (Global Marine Distress Safety System) is a worldwide-mandated response to a need for integrated communications systems for safety of life at sea. Tough GMDSS standards will improve emergency responses from seashore facilities when any GMDSS ship presses the big red button, sending a digital signal to a geostationary satellite with latitude and longitude, type of distress, ship ID, and other particulars. Two-way marine radio equipment must meet tough standards to be certified for GMDSS installations, such as being waterproof, capable of digital selective calling, and possessing long battery life. GMDSS will place emphasis on automated signaling, so by 1999 many two-way radios may be void of the microphone for sending out distress calls. You may also find that the marine handheld radio in your back pocket is also automatically sending your exact location to an overhead satellite, too! Big brother will indeed be listening!

What does GMRS stand for?
—Donna Wolcott, Huntington Beach, California

GMRS stands for General Mobile Radio Service and is covered under Part 95, Subpart A, of the FCC's rules. GMRS channels are located on UHF at 462 and 467 MHz and may be used for simplex, repeater semi-duplex, and interstitial channel low-power unit-to-unit communications with no radio test required. It is a family radio service, specifically designed for intercommunication among family members and close associates. It is not a business band radio service; however, some businesses licensed on GMRS may continue operations until they modify their licenses. There have been petitions to simplify GMRS licensing to allow quicker access to frequencies and equipment for short-range communications.

What does DSC stand for?
—Jack Anderson, Norfolk, Virginia

DSC is the acronym for Maritime Digital Selective Calling. It is used on marine VHF bands as well as on marine HF single sideband for routine, safety and distress calls to other ships and shore stations by simply pressing a single button. DSC will soon be mandated for most boats by 1999.

Are amateur radio repeaters that are locked out through the use of a CTCSS [Subaudible Continuous Tone-Squelch System] considered private?
—Dan Owens, Fort Myers, Florida

Not necessarily. CTCSS, more commonly called tone, is a device on the repeater that keeps errant signals from triggering the repeater to retransmit. Unless the signal on frequency has the specific subaudible tone, the repeater remains silent. The tone requirement may be in place to keep the repeater from accidentally triggering on other signals at the repeater, mountain-top or tower site. If you know the CTCSS tone frequency of the repeater, chances are that it is an open repeater if it responds to your signal with tone. Private and closed repeaters usually require more than tone, such as Touch-Tone access, to keep them limited to only closed membership. CTCSS also is known by trademarks such as Private Line or PL (Motorola).

Get smart, fast!

RadioShack's new PRO-2040 scanner searches *smarter* and *faster* so you hear more of the action!

- **Search-lockout stores up to 50 frequencies to skip while searching**
- **Data-skip prevents annoying lockups on non-voice signals during search**
- **Searches for new and unlisted channels at up to *300* steps per second!**

Meet the PRO-2040, RadioShack's most intelligent way ever to scan the action radio bands.

What makes it so bright is its advanced *smart-search* features. Data-skip and 50 search lockouts prevent freeze-ups on undesired frequencies during searches for new channels. And at a blazing 300 channels per second, it snags those elusive signals slower scanners often miss.

PRO-2040 gives you 800 MHz and VHF-air bands, of course... 100-channel memory... priority mode... and one-touch NOAA Weather Radio. And at only $219.99, it's definitely a smart buy... sure to go fast! Catch it at America's first name in radio—your nearby RadioShack.

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In The Line Of Fire

Everyday, brave men and women risk their lives for others. Their battles can be heard—almost felt—over your scanner.

By Edward Muro

In the words of former New York City firefighter Dennis Smith, "Someone has to deal with fire. When people first bonded together in small societies, they realized that if fire were not dealt with it would consume everything in its path. In our highly developed technological society, the same confrontation with fire exists as it has for thousands of years. Here in America, those men and women whose responsibility it is to deal with fire are those seemingly easygoing folks down at the local firehouse."

Fire departments come in all shapes and sizes, depending upon the needs of the community. And we can assume that their communications systems will vary accordingly. Generally, the larger the population of a municipality, the more calls its fire department will receive—and the more complex its radio system will be.

According to rules established by the Federal Communications Commission, any territory, possession, state, county, city, town, or similar governmental entity, and persons or organizations charged with specific fire protection activities are eligible to hold licenses in the Fire Radio Service to operate radio stations for transmission of communications essential to official fire activities of the licensee. Naturally, this gives scanner monitors plenty of radio action to listen in on.

The Sounds of Traffic

In larger cities, such as New York, Los Angeles, or Boston, the city may be divided into geographic areas, each having its own dispatch frequency. In these larger cities, each engine or ladder company may get as many as six to 10 runs a day. In a rural community somewhere in Arkansas or Montana, for example, there may only be several calls per month. In "Small Town, USA," the only radio traffic you monitor on a daily basis might be a radio test.

Another factor that will influence the type and amount of radio traffic you monitor is whether the department is paid or volunteer. Again, this will be determined by the needs of the community. In metropolitan areas, fire protection is usually supplied by paid civil service employees, but the majority of the departments across America are volunteer.

Fourth alarm firefighters retreat as flames engulf the Fulton Fish Market in New York City's busy South Street Seaport. (Photo courtesy of the F.D.N.Y.)

Billows of smoke rise to frame New York City's financial district during the Fulton Fish Market fire. (Photo courtesy of F.D.N.Y.)

There are several types of radio systems in use. They are simplex, semi-duplex, full-duplex, repeatered, and trunked. The particular system will vary depending upon the size of the department and terrain of the locality. (There are numerous books, such as *Police Call* available at Radio Shack, that go into detail on the technical aspects of these systems.)

How Are Departments Dispatched?

When a call for help comes in, the firefighters have to be dispatched to the scene. This can be done in several ways. The larger paid departments will have full-time paid dispatchers that operate out of what is called, in New York, a telegraph office. Most cities have special centers or 911 offices staffed by dispatchers. Dispatchers will contact the appropriate units by dispatch frequency, a PA system linked directly to the firehouse, or a Mobile Data Terminal (MDT).

The volunteer departments operate somewhat differently. A busier volunteer department may employ its own dispatcher, or several communities may form an alliance and have a centralized location dispatch for them. In some suburban areas, the county government may provide a dispatch facility for the entire county. In some other communities, the

Fighting a fire on New York's West Side from the ground and from the air with bucket on hook and ladder. (Photo courtesy of the F.D.N.Y.)

Fighting Fires in New York City

The first signs of organized fire protection in New York City date back to the mid 1600s. A volunteer department served in providing fire protection in Manhattan until the mid 1800s. It was near this time that a paid municipal fire department was formed for the City of New York. It became known as F.D.N.Y. (Fire Department of New York). To this day, you will see the markings F.D.N.Y. on all New York City Fire Department vehicles. Near the turn of the century, there were many paid and volunteer departments serving the residents of Brooklyn, Queens, Staten Island, and the Bronx. Around this time, part of Queens became what is known today as Nassau County, while the remainder of Queens and the other boroughs became incorporated into the City of New York. Eleven volunteer companies still exist in New York.

Even as the makeup of the city changed, ethnically, structurally, technologically, and fiscally, the goal of the department has remained the same—to protect people and property from disaster. The continual changes through time have forced the fire department to adapt in order to meet the demands and challenges that lay ahead.

There is a large controversy right now concerning the removal of street corner fire alarm boxes. The current administration believes that in these times more people have access to telephones than in the past and that the city could save millions of dollars in maintenance costs by removing the fire alarm box system. They also contend that the removal of the system will cut down on the number of false alarms, freeing fire fighters to respond to real emergencies. The opponents of removing the alarm boxes claim that in certain circumstances these boxes are sometimes the fastest, or even the only, link to help.

Another big change that the department is currently undergoing is the managerial take-over of the New York City Emergency Medical Service, formerly run by the Health & Hospitals Corporation. Certain fire companies have been included in a new program called "The First Responders Program," where fire personnel are being trained in emergency medical care.

Currently, the fire department is run by a commissioner and his deputies as well as a uniformed chief of department. The commissioner and his staff are political appointees, while the uniformed personnel are civil servants.

Prior to the miniaturization of electronics, apparatus were dispatched using a manual bell system placed in fire houses. These bells are set off at the central office and a certain combination of gongs will alert a company to respond to a particular emergency and its location.

In the mid 1930s, two-way radios were put to use and the department could be heard at the top of the AM broadcast band. It wasn't until the 1960s that radios were installed in all equipment and transmissions were switched to VHF-FM. In the 1970s, computer-assisted dispatching came into play and is continually improving. The department's Starfire computer system has just been upgraded.

Currently, there are teleprinters in the firehouses that dispatch alarms. There are plans to update the teleprinters to modern computer equipment in the future but as yet no timetable has been set. There are, however, state-of-the-art mobile data terminals (MDTs) being installed in vehicles. Companies that are not yet equipped with MDTs are contacted via radio. In addition, alarms are broadcast on the borough radio frequency after they have been received by the teleprinter.

Calls from the public can be received by the fire department in several different ways. The first is by police operator transfer of a 911 call. The second is through the fire alarm box system, and the third is through direct seven-digit phone lines connected to each borough office. Thanks to this redundant system, the public is almost always assured that no matter where or when the emergency, the department's near 14,000 personnel and close to 1,100 vehicles will be available to them.

F.D.N.Y. Radio Code Signals

10-1	Call your quarters (or other unit, if so instructed)
10-2	Return to your quarters
10-3	Call the dispatcher by telephone
10-4	Acknowledgment
10-5	Repeat message
10-6	Stand by
10-7	Verify address
10-8	In service by radio Code 1: Left another unit's quarters and on the air Code 2: Outside of normal response area
10-9	Off the air
10-10	Location
10-11	Request for radio test count
10-12	First arriving unit, give preliminary
10-13	Fire marshal needs immediate police assistance
10-14	Roster-staffed (manned) engine company—acknowledged call
10-18	Return all units except engine (squad) and ladder company required at scene
10-19	Return all units except engine or ladder
10-20	Proceed at reduced speed
10-21	Brush fire
10-22	Outside rubbish fire
10-23	Abandoned/derelict vehicle fire
10-24	Auto fire (value greater than salvage)
10-25	Manhole or transformer vault fire Code 1: Fire has extended into building Code 2: Fire has blown or smoke under pressure is issuing from one or more manholes Code 3: Smoke seeping from manhole

10-26 Food on stove

10-27 Compactor fire (fire did not extend from compactor or shaft)

10-28 Fire in subway or railroad system
Code 1: Fire in tunnel or in other underground area
Code 2: Fire above ground or in open cut

10-31 Clogged incinerator

10-32 Defective oil burner

10-33 Odor of smoke (includes nearby working fires and friendly fires, such as barbecues)

10-34 Sprinkler malfunction
Without code, frozen, damaged pipe; or not covered by codes 1,2, or 3
Code 1: Sprinkler malfunction (surge in pressure, alarm valve defective)
Code 2: Working on system
Code 3: System activated by friendly fire or other heat source not associated with an accidental fire

10-35 Automatic alarm system emergency
Code1: Defective alarm device/system
Code 2: Unwarranted alarm (no defect, cigarette smoke, low battery alarm signal, etc.)
Code 3:"Recorded" alarm (no cause for alarm)

10-36 Auto emergency
Code 1: Accident and/or wash down gasoline spillage
Code 2: Accident, no gasoline spillage

10-37 Assist civilian (applies whether or not F.D.-related)
Code 1: Elevator emergency

10-38 Steam leak in structure

10-39 Water condition
Code 1: Water leak in structure
Code 2: Broken water main in street

10-40 Utility emergency
Without code, situation is other than as described in code 1 or 2
Code 1: Gas emergency (gas main leak: uncontrollable gas leak in structure)
Code 2: Electrical emergency (wires down; sparking fixture; short circuit)

10-41 Incendiary or suspicious fire—notify Fire Marshal
Code 1: Occupied structure. Definite indications of incendiarism. Fire Marshal to respond.
Code 2: Occupied structure. While no definite indications of incendiarism, witness and/or other civilians have information that may be of value. Fire Marshal to respond.
Code 3: Vacant building. Heavy volume indicates definite incendiarism. Fire Marshal to respond as other priorities permit.
Code 4: Vacant building. Obviously incendiary and it appears that there is very little chance for information leading to same. Notification for Fire Marshal's evaluation.

10-44 Request for public ambulance

10-45 D.O.A. or serious injury
Code 1: Victim deceased
Code 2: Life-threatening injuries
Code 3: Victim suffering serious injuries

10-47 Request for police assistance (specify)

10-48 Request for police assistance (harassment)

10-51 Cancellation of all outside activities for the period

10-59 Water pressure alert—Phase I

10-60 Major emergency response

10-68 Restrict use of telephone, voice alarm and radio to absolute minimum

10-70 In-line pumping

10-75 Request for three engines (two engines and one squad), two ladders, and a Battalion Chief response

10-76 Request for the response of four engines, four ladders, one rescue company, two Battalion Chiefs, one Deputy Chief and the Field Communications Unit for a fire in a high rise building.

10-77 Request for the response of one additional Deputy Chief, two additional Battalion Chiefs, one additional Rescue Company, the High Rise Unit, a Command Post Company and the Mask Service Unit for a fire in a High Rise building.

10-80 Hazardous materials incident.
Code 1: A hazardous material incident which involves a severe hazard or extremely large area and which will require expert assistance from specialized agencies. An incident where numerous civilians are injured or exposed.
Code 2: A hazardous material incident involving a lesser hazard or a smaller area and requiring a smaller evacuation area.
Code 3: A hazardous material incident which can be controlled by responding units and the Hazardous Materials Response Team (HMRT) and does not require evacuation of other than the involved structure or immediate area if outdoors.

10-84 Announce arrival at box.

10-86 Foam operation—requires foam task force
Code 1: All flouroprotein foam units respond
Code 2: Flouroprotein foam carriers respond
Code 3: High expansion foam required

10-92 Malicious false alarm

10-99 Units will be operating for at least 30 minutes

10-100 Restricted use of city-wide radio frequency due to high rise fire

Fire chief and line officer discuss tactics over field communications unit operating at multiple alarm. (Photo courtesy of the F.D.N.Y.)

police dispatchers may also dispatch for the fire department and ambulance corps.

A volunteer fire department is a far different beast from a paid department when it comes to dispatching and responding to a call. In the paid departments, the firemen are basically just sitting around the firehouse waiting for a call. In a volunteer department, however, the firefighters spend the day wrapped up in their own lives and jobs. One minute, Jim may be pumping gas at the local filling station while across town Larry the dentist has a patient in his chair. Chief Stone may be installing an alarm in someone's home three towns away. But when a call for a house fire comes in, all these people have to jump into the role of firefighter. It is the dispatcher's responsibility to see that they are notified.

Most volunteer departments share a frequency with several nearby towns. When the dispatcher is about to dispatch a call, he'll transmit a set of tones that will activate the pagers of the companies he wants to respond. Prior to the miniaturization of electronics, department members may have had a somewhat larger alerting receiver in their home, usually called a Plectron. But, while they were out, they had to rely on loud horns, similar to air raid sirens of the 1950s, placed around town to notify them of a fire. Many rural departments still rely on outdoor sirens today.

After the tones are transmitted and the call goes out on the dispatch frequency, most communications will switch over to the battalion or response frequency. There may also be frequencies used at the scene for fireground coordination.

In relatively small towns, the firefighters will race to the fire house when the call is transmitted, jump on to the fire

Field communications unit at the scene of a Manhattan second alarm. (Photo courtesy of the F.D.N.Y.)

Frequencies to Search

National

33.420–33.980	154.130–154.445
46.060–46.500	453.050–453.950
153.770–154.070 (.06 MHz spacing)	(.05 MHz spacing) 460.575-460.625

Sampling of State Frequencies

Connecticut

Hartford	154.265, 154.310
Plainville	33.580, 33.940, 856.2625
Bridgeport	153.770
Bethel	33.700
Cos Cob	154.175
Darien	33.620, 33.860
Fairfield	46.060, 460.600
Byram	154.175
New London	453.900
Mystic	33.900, 33.92

California

Beverly Hills	460.625, 460.575
Culver City	482.3625, 482.5625
Santa Fe Springs	154.250, 154.280

Florida

Altomonte Springs	154.205, 154.415
Daytona Beach	154.175
Daytona Beach Shores	154.310
De Land	154.220
Orlando	453.050, 453.150, 453.250, 453.350
Metro Dade County	453.600, 453.700, 453.800

Iowa

Des Moines	460.625
Ames	453.400, 453.050
Dubuque	154.130
Burlington	154.430
Davenport	460.575, 460.600

Massachusetts

Ashby	33.700
Ashland	33.980, 46.460
Ayer	46.140
Concord	33.660, 33.980, 46.400, 46.500
Lexington	154.220, 154.265, 154.340
Lowell	33.660, 154.010, 154.205

New Jersey

Bergen County	33.860, 154.160, 154.280
Union County	46.060
Ocean County	33.780
Camden	153.770
Atlantic City	154.025
Trenton	460.575

New York

Bronx/Staten Island	154.190
Manhattan	154.250
Brooklyn	154.370
Queens	154.400
Citywide	154.430
NYC Fire Marshalls and High Rise Ops	460.575, 460.625
Nassau County	46.100
Rockville Centre	33.900
Suffolk County	46.460
Westchester County	46.140
Rockland County	46.080, 46.180
Orange County	154.205

Pennsylvania

Philadelphia	154.235, 154.145
Lancaster	33.82
Allentown	453.475
Harrisburg	453.700
Pittsburgh	154.130

Rhode Island

Newport	46.060, 46.480
Tiverton	46.200

South Carolina

Hilton Head Island	154.070
Sea Pines Forest Beach	154.145, 154.205

truck, and respond to the call. In some geographically larger towns, the trucks will roll with just one or two firefighters, leaving the rest to respond directly to the scene.

Get Active

In your hobby efforts, you may find that local firefighters are more willing to discuss their radio system with you than someone in a law enforcement agency. I've found them also very generous in giving out frequencies and copies of their radio code signals.

If you have any questions or comments, feel free to drop me a line at P.O. Box 308, Cedarhurst, NY 11516. Please include a S.A.S.E. for a personal reply. I can also be reached via the Internet at ny041ed@AOL.COM.

The author would like to dedicate this article to the memory of the many brave men and women who have given their lives to protect us from the inferno. ■

Sources of Fire-Related Material

In addition to monitoring radio communications, there are other hobbies pursued by those interested in the fire service. Some people enjoy collecting and preserving antique fire engines, others collect models, some enjoy trading patches, and others photograph fire scenes. There are services popping up that use alphanumeric pagers to notify buffs of fires as they are happening. There are also many computer bulletin boards catering to firefighters and fire buffs. You might want to check out the following:

- *The International Fire Buffs Associates*, P.O. Box 23456, Milwaukee, WI 53223
- *The Metro Emergency BBS* (FREE Computer BBS) @ (516) 488-4325 (modem line)
- *Breaking News Network* (Paging Service), P.O. Box 569, Ridgefield, NJ 07657, (800) 826-0655
- *The New York Firefighters Friend* (Firematic Novelties & Shirts), ATTN: Nate, 263 Lafayette Street, New York, NY 10012
- *Firehouse Magazine*, P.O. Box 52824, Boulder, CO 80321-2824

Tuning In Cajun Country—Louisiana

The nights are sultry, the jazz is cool, and the scanning action's as hot as you'll find anywhere.

By Chuck Gysi, N2DUP

Louisiana—the Bayou State—is probably best known for the Mardi Gras in New Orleans, the Mississippi River, the Gulf of Mexico, and now riverboat casino gambling. Visitors to this exciting state have plenty of scanning action to check out upon their arrival.

Radio! has compiled this extensive frequency list to help you enjoy your stay, or, if you live there, to offer you some possible additional frequencies to scan. Here are the most important frequencies to monitor:

Statewide

Louisiana State Police 800 MHz

NOTE: State police are switching from a VHF system to a statewide trunked 800-MHz radio system. As the trunked system goes online, frequencies will be configured as needed. Here's a list of frequencies you should check out on 800 MHz for Louisiana State Police:

851.5625	856.9625
851.6625	857.9875
851.6875	857.2375
852.0625	857.4375
852.1875	857.4625
852.5375	857.7625
852.6625	857.9625
853.0125	857.9875
853.1375	858.2375
853.4875	858.4375
853.5875	858.4625
853.6125	858.7625
853.9625	858.9625
854.0875	858.9875
854.4375	859.2375
854.5625	859.4375
854.9125	859.4625
855.0125	859.7625
855.3875	859.9625

There's probably no time more exciting in New Orleans than Mardi Gras each February. Be sure to check New Orleans Police Department's 460-MHz channels for all the action. (Courtesy of Louisiana Office of Tourism.)

Jazz at its finest attracts many visitors to New Orleans. But you probably won't need your scanner when listening to the flavor of the city. (Courtesy of Louisiana Office of Tourism.)

The Art Deco state capitol in Baton Rouge is the nation's tallest state capitol—at 34 stories. Baton Rouge police can be found in the 155-MHz band. (Courtesy of Louisiana Office of Tourism.)

855.5125	859.9875
855.8625	860.2375
855.9875	860.4375
856.2375	860.4625
856.4375	860.7625
856.4625	860.9625
856.7625	860.9875

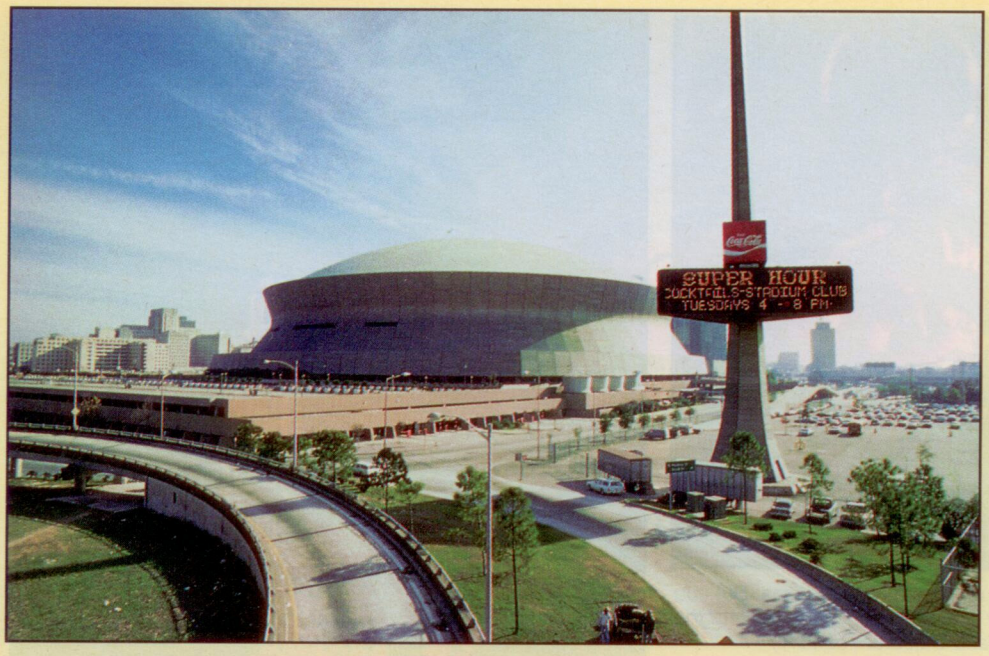
Louisiana State Police VHF

NOTE: The following VHF frequencies are still in use as the 800-MHz system is implemented statewide. Check these frequencies as well as the 800-MHz channels listed above:

155.505	Troop A base, Baton Rouge
154.875	Troop A mobile, Baton Rouge
158.970	Troop B base, New Orleans
155.655	Troop B mobile, New Orleans
155.565	Troop C base, Gray; Troop F base, Monroe
154.920	Troop C mobile, Gray; Troop F mobile, Monroe
154.935	Troop D base, Lake Charles; Troop G base, Shreveport
155.625	Troop D mobile, Lake Charles; Troop G base, Shreveport
154.755	Troop E base, Alexandria
155.445	Troop E mobile, Alexandria
154.905	Troop H base, Leesville
155.460	Troop H mobile, Leesville
154.695	Troop I base, Lafayette
155.595	Troop I mobile, Lafayette
154.755	Troop J base, Baton Rouge HQ
159.315	Troop J mobile, Baton Rouge HQ
155.850	Troop K base, Opelousas
154.815	Troop K mobile, Opelousas
155.910	Troop L base, Slidell
154.680	Troop L mobile, Slidell
39.50	Police coordination F1
39.30	Dispatch (except Troop B) F2
39.54	Operations F3, Baton Rouge
39.20	Troops A and K F4
39.28	Troop B dispatch
39.32	Troop K
154.950	Troop F
155.475	Nationwide Law Enforcement Emergency Frequency
154.950	Tac 1 base
151.280	Tac 1 mobile
154.800	Tac 2 base
159.450	Tac 2 mobile
155.845	Emergency management

Department of Highways

47.32	All districts F1
47.38	Southeast and central F2



The Superdome in New Orleans is quite a familiar sight for football fans. Police operations there can be found on 453.425 and 453.775 MHz. (Courtesy of Louisiana Office of Tourism.)

47.30	South central and northwest F3
47.40	Northeast and east central F4
47.28	Southwest and east central F5
47.36	Northeast F6

Conservation

31.50	Fish and Game statewide
151.325	Forestry operations primary
151.235	Forestry operations secondary
856.2625	Environmental response

National Forests and Parks

169.675	Jean Lafitte National Historic Park
169.925	Kisatchie National Forest primary
168.625	Kisatchie National Forest air operations
170.000	Kisatchie National Forest air operations
164.9375	Kisatchie National Forest
171.475	Nantahala National Forest primary

Baton Rouge

Police

155.610	F1
155.670	F2
155.730	F3
155.535	F4

Fire

154.430	Dispatch F1
154.355	F2
453.800	Paging
154.445	County fire

Lake Charles

Public Safety Trunked (Police and Fire)

856.2125
857.2125
858.2125
859.2125
860.2125

Police

155.010	Dispatch F1
155.370	F2
155.310	City marshal

Fire

154.235	Dispatch F1
154.280	F2

New Orleans

Public Safety

NOTE: New Orleans has received licenses for trunked public safety radio systems on the following frequencies. Monitor these channels for possible activity as the systems are implemented.

System One

856.7875	858.8125
856.8125	859.7875
857.7875	859.8125
857.8125	860.7875
858.7875	860.8125

System Two

866.0125 (mutual aid)	867.450
866.0375	867.5125 (mutual aid)
866.1875	867.5375
866.2125	867.575
866.2375	867.6875
866.2875	867.800
866.3375	867.8875
866.4125	867.950
866.4375	867.975

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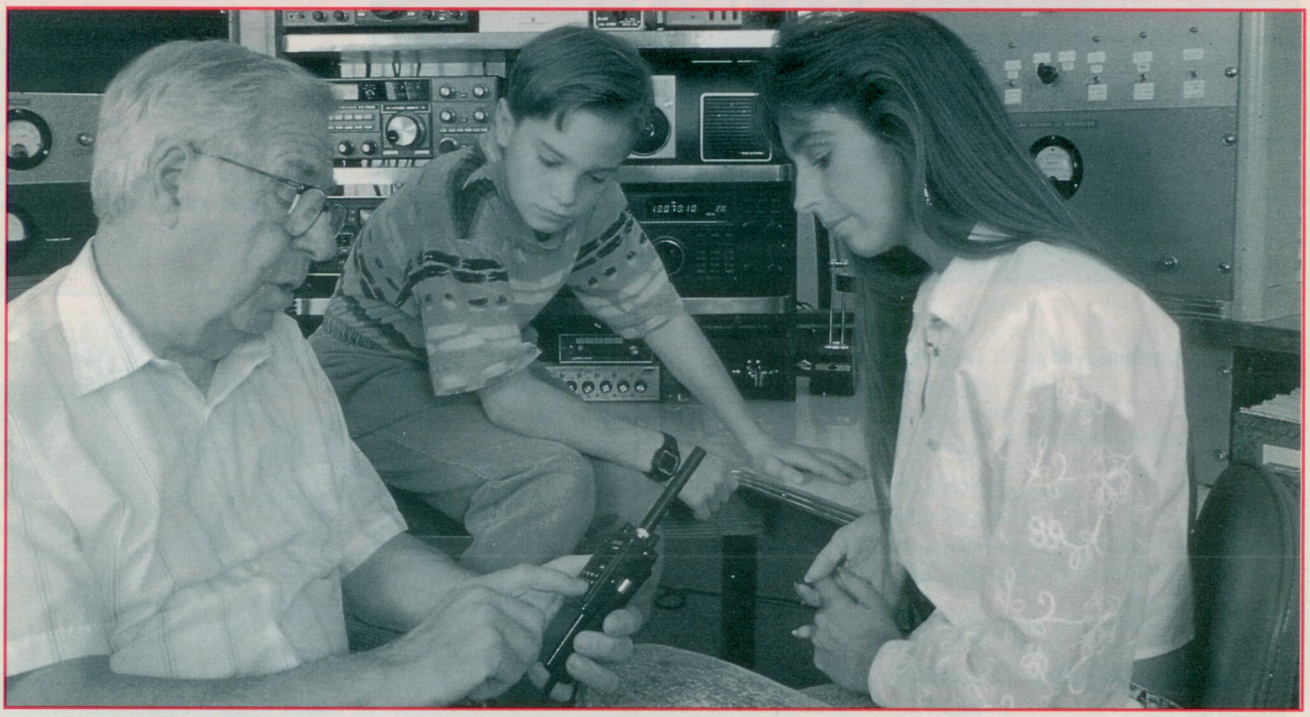

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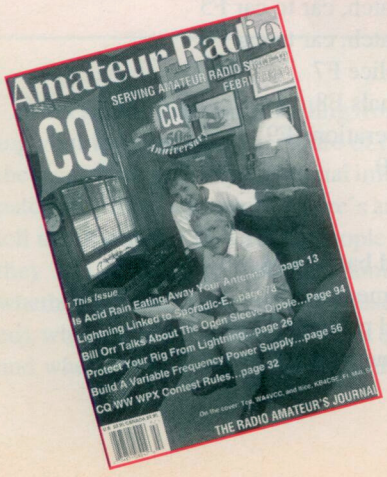
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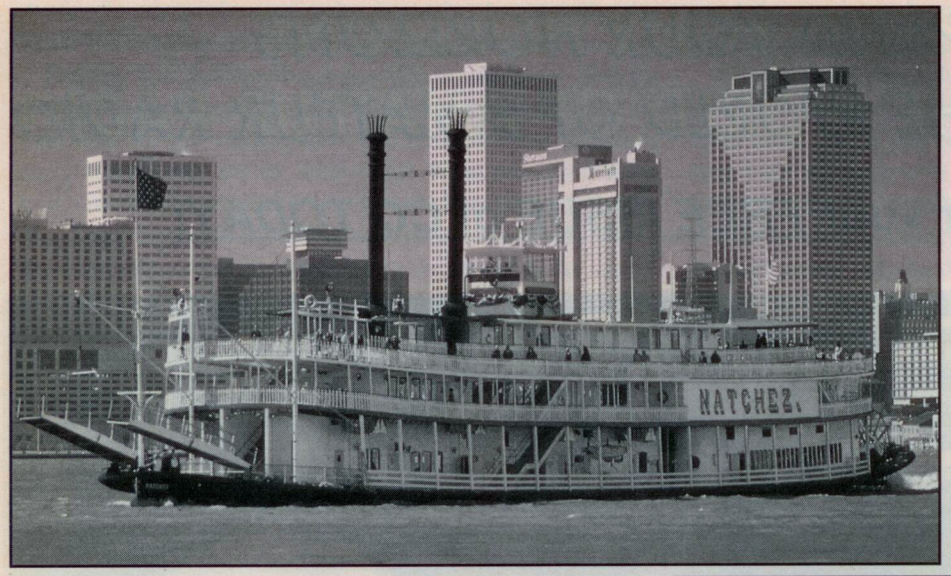


A riverboat cruises on the Mississippi River against the backdrop of downtown New Orleans. Be sure to monitor the VHF marine band frequencies between 156–157 MHz. (Courtesy New Orleans Metropolitan Convention and Visitors Bureau.)

Mardi Gras in New Orleans is quite the wild time each year. Be sure to monitor the many downtown hotels' security staffs in the 461–465 MHz band.

866.4625
866.5125 (mutual aid)
866.5375
866.575
866.6875
866.7125
866.7375
866.7625
866.875
866.925
866.9625
867.0125 (mutual aid)
867.2125
867.2375
867.2875
867.3875

868.0125 (mutual aid)
868.0875
868.1375
868.225
868.250
868.275
868.400
868.450
868.500
868.600
868.675
868.700
868.750
868.875
868.925
868.950

Police

460.025 Central, French Quarter F1
460.050 West of Louisiana Avenue F2
460.100 North of Gentilly Road; East of Industrial Canal F3
460.125 Algiers; West Bank; car to car F4
460.200 Algiers; West Bank; East of Esplanade Avenue F5
460.225 Between Toledano Street & Ponchartrain Expressway F6
460.300 Tactical; info F7
460.325 Felony squad; special details F8
460.400 Internal affairs; SWAT F9
460.475 Detectives F10
460.425 Tactical; car to car F11
460.500 Phone calls F12

Fire

460.575 Dispatch
460.600 Fireground F1 odd-number zones
460.625 Fireground F2 even-number zones

453.150 Paging
453.800 Teleprinters; phone calls
462.950 EMS dispatch F1
462.975 EMS dispatch F2

Shreveport

Police

453.900 Tactical, traffic F1
453.800 Information, detectives F2
453.950 North, East dispatch F3
453.825 South, West dispatch F4
453.450 Field dispatch, car to car F5
453.550 Field dispatch, car to car F6
453.650 Airport police F7
453.700 City marshals F8
453.500 Special operations F9
155.310 Paging F10

Fire

154.310 Fireground backup F1
154.445 Dispatch, medics F2
154.355 Fireground primary F3
154.400 Dispatch, non-emergency units F4

Scanner Tips & Techniques

By Tom Kneitel, K2AES

Here's a scanner idea for you to try that will surely come in handy. It offers a relatively inexpensive solution to the common problem of poor signal pick-up when you attempt to use a handheld scanner as a desktop unit from a temporary location. You expect the scanner to receive as well as any base station, but the signals just aren't as loud and clear. Remember that your handheld doesn't have the advantage of a base station antenna. Well, wily old scanner buffs have a way of improving the situation, and it's not a solution that would readily come to mind, either!

Who'd Have Thought...

The answer arrives from left field in the form of Radio Shack's Portable Amplified TV/FM Antenna (catalog #15-1607), which sells for a mere $24.99. Tell the truth, would you have thought to put *that* to use as a scanner antenna? The antenna was designed to improve reception on pocket-sized mini-screen TV receivers, as well as on FM portables. It does a really gook job at it, and, as an extra bonus, has a matte black finish so it even looks nice.

Keep in mind that in order to boost the strength of weak FM and VHF/UHF TV signals, a device such as this would have to cover, at the least, from about 50 through 900 MHz. That's perfect for use with scanners because the bands you'll be monitoring lie within this range. This gizmo comes with twin nine-section outboard telescoping antennas mounted on its sides. If they're extended outwards, the device produces highly bidirectional reception. If they're extended parallel to one another, they behave as if they were an omnidirectional ground plane, receiving in all directions. Either way, the device performs well, just like a costly antenna system.

You can slightly tinker with the length of the antennas and maximize the reception in specific bands. The higher frequencies use the shorter antenna lengths, of course. A bit of experimentation shows you the best length for each of your favorite bands.

The amplifier runs from its (supplied) AC adapter, or will also run for more than 50 hours on two AA batteries. It's light, just a bit larger than a deck of playing cards, and the antennas fold down quite flat so you can carry it around in your pocket. There's a stand that allows the unit to be adjusted for standing upright on a desk or it may be placed flat on its back. Keep in mind that this was intended for TV and FM set use and the signals emerging from the device must be slightly readied to be fed into a scanner's antenna connector. Not a big problem, just a matter of using a widely available RF adapter.

Designed to boost weak FM and VHF/UHF TV signals from about 50 through 900 MHz, the Portable Amplified TV/FM Antenna (catalog #15-1607) is also perfect for scanner use.

The device can be easily mated to most modern scanners using the Radio Shack adapter for the standard BNC connector (scanner) end, and another to accept the cord and plug that feeds signals from the amplifier. This adds a few dollars to the cost. Radio Shack's catalog will show the proper adapters for any connector match.

The signal booster has a switch that permits turning the amplifier off and bypassing its circuitry, then allowing you to flip it back on when it's needed to help with a weak signal.

Your Gain

You can expect this amplifier to provide gain of at least 10 dB to about 470 MHz, then at least 8 dB above that. For a rather small investment, this turns out to be quite a decent makeshift indoor scanner antenna, especially when you consider that it's intended for something else entirely.

You can also use this trick for a regular base station scanner if you aren't able to put up an outside antenna or if your

Citizens Band 10-Codes

To facilitate communications and permit users to understand each other, especially in a noisy environment, a system of abbreviations known as 10-codes has evolved for use by CBers. Here are some of the more common 10-codes and their meanings.

10-1	Receiving poorly
10-2	Receiving well
10-3	Stop transmitting
10-4	ok, message received
10-5	Relay message
10-6	Busy, stand by
10-7	Out of service, leaving the air
10-8	In service, subject to call
10-9	Repeat message
10-10	Transmission completed, standing by
10-11	Talking too rapidly
10-12	Visitors present
10-13	Advise weather/road conditions
10-16	Make pick up at
10-17	Urgent business
10-18	Anything for us?
10-19	Nothing for you, return to base
10-20	My location is
10-21	Call by telephone
10-22	Report in person to
10-23	Stand by
10-24	Completed last assignment
10-25	Can you contact
10-26	Disregard last information
10-27	I am moving to channel
10-28	Identify your station
10-29	Time is up for contact
10-30	Does not conform to FCC rules
10-32	I will give you a radio check
10-33	EMERGENCY TRAFFIC/MESSAGE
10-34	Trouble at this station
10-35	Confidential information
10-36	Correct time is
10-37	Wrecker needed at
10-38	Ambulance needed at
10-39	Your message delivered
10-41	Please turn to channel
10-42	Traffic accident at
10-43	Traffic tie-up at
10-44	I have a message for you
10-45	All units within range please report to
10-50	Break channel
10-60	What is next message number?
10-62	Unable to copy, use phone
10-63	Net directed to
10-64	Net clear
10-65	Awaiting your next message/assignment
10-67	All units comply
10-70	Fire at
10-71	Proceed with transmission in sequence
10-77	Negative contact
10-81	Reserve hotel room for
10-82	Reserve room for
10-84	My telephone number is
10-85	My address is
10-91	Talk closer to mike
10-93	Check my frequency on this channel
10-94	Please give me a long count
10-99	Mission completed, all units secure
10-200	Police needed at

Frequency Spotlight—Itinerant Businesses

To issue a business radio license, the FCC generally demands that applicants specify either a permanent location or a general operating area for the communications system they intend using. There are instances when this isn't possible, such as when a business user needs to be able to operate anywhere in the U.S. These include somewhat glamorous users like circuses, carnivals, sports teams, rock bands, and public relations personnel accompanying celebrities. Of course, many other businesses, including those involved in security, recreational, research, scientific, and ecological activities, also travel widely.

The FCC classifies widely roaming businesses as *itinerant* users. It has given them a dedicated VHF frequency, 151.625 MHz, which can produce unusual chatter you might not otherwise run across. Most communications on 151.625 MHz are between low-powered handheld transceivers. Since this frequency is readily accessible on all scanners, you'll certainly want to push those magic programming buttons.

Tom's Tip: There are a few other frequencies that are also favorite haunts for itinerants and others who often use low-power handheld radios, so be sure to keep an ear there, too. Punch up the following: 154.57, 154.60, 464.50, 464.55, 469.50, and 469.55 MHz.

Radio Shack's BTX-120 is a popular 1-watt handheld transceiver that's ready to operate on 154.60 MHz.

outside antenna goes out of service. While it won't duplicate the high performance of a roof-mounted antenna made for scanner use, it should provide better reception than most standard rubberized and telescoping whip antennas used indoors.

Macho Band

Ever wonder about that 225 to 400 MHz band and why it's included in only a few of the most feature-laden scanners? What's going on there, and why might it be desirable to monitor this band?

Known as the UHF Military Aeronautical Band, these channels don't contain any of the usual police, fire, maritime, EMS, commercial aeronautical, business radio, or other activities most scannists direct their monitoring efforts towards. That's why equipment manufacturers never had widespread customer demand for these receiving capabilities.

Yet this band contains loads of exciting communications activity. And, thanks to the inclusion of the band in several more sophisticated scanners over the past few years, it's been attracting a growing cadre of enthusiastic "insiders" who monitor it with much gusto.

It's possible to monitor U.S. Coast Guard rescue missions on 282.8, 381.8, 383.9 MHz, and many other frequencies. Military transports can be heard on 349.4 MHz. There are air-to-air refueling missions, practice dog fights, weather communications, military control towers, National Guard choppers, and many others activities here.

That's the reason that odd band is included in a couple of selected scanners. It's a great place to monitor, long known only to a few. Now you know about it, too!

Why not keep in touch? Got any hints or kinks? Any questions about scanning? Send a card or letter to me here at *Radio!*

Low Band DX—Going The Distance

Who says DX is just for hams and shortwave listeners? Thanks to propagation, we scanner monitors have plenty of long-distance excitement, too!

By Donald E. Dickerson, N9CUE

Your scanner locked up on 41.50 MHz. You hear two voices through high level background noise. Their voices are choppy and slightly muffled. They're talking about range, altitude, fire angles, targets, locking, arming, and firing Hellfire missiles.

You're listening to crew conversations between pilots of two Army Apache attack helicopters talking about their desert targets during war games somewhere in the southwest part of the country. They may be on their way to a war. You hear all this on your scanner, with iced tea in hand, from your listening post in Indianapolis.

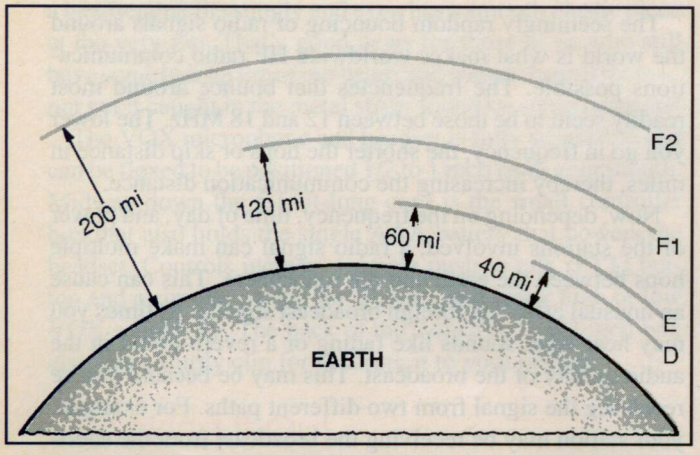
You're listening to police calls on low band at your home in Pennsylvania. After a few minutes, you catch a callsign (station ID) and realize from the location names and accents that you're listening to a police department in Georgia.

You work for an ambulance service as a telecommunications specialist (dispatcher), and, while you're talking to units in the field, you hear a call from a mobile trying to contact its Detroit office—but you're in Iowa. When you answer his call and give him your location, the ambulance driver is a little more than confused.

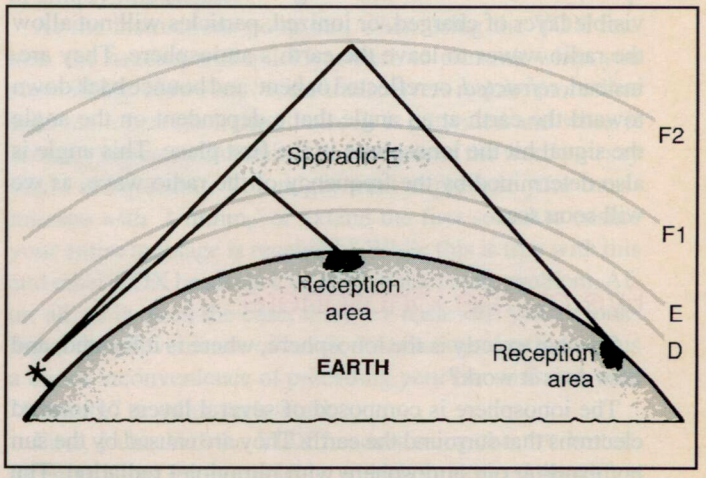
Impossible you say? No! Even stranger things can happen when you enter the twilight zone of radio propagation.

Propagation's the Name...

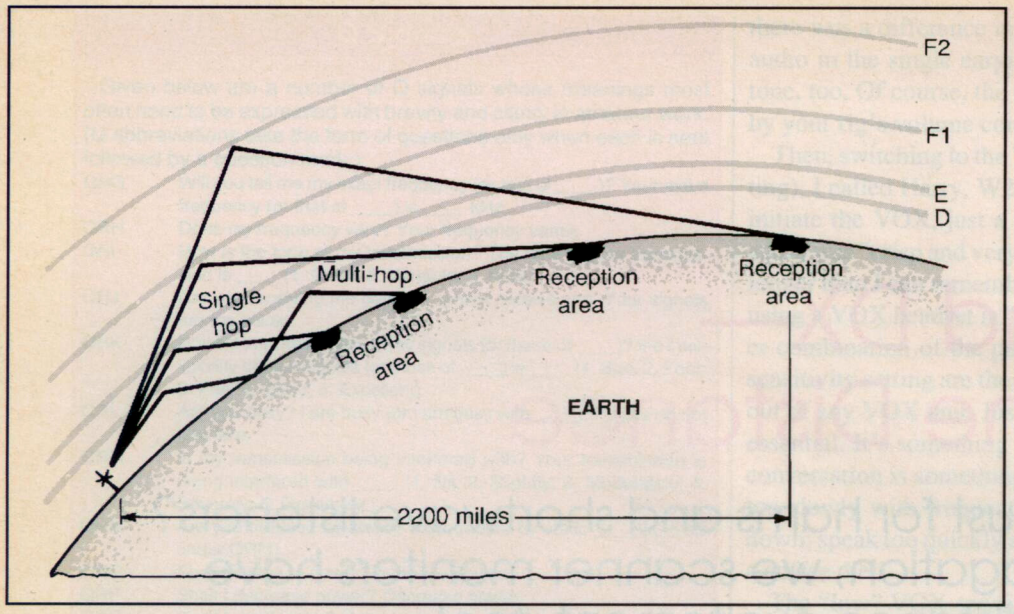
Propagation is a term used to describe, in general, the characteristics or behavior of radio signals once they leave an antenna. We'll look at some of these behavior patterns at various frequencies because radio waves behave unique-



Layers of the ionosphere displayed at their average altitude above the earth.



F2 and S-E are the main vehicles for low band skip.



F2 skip will extend to a maximum of about 2,200 miles on low band.

ly at different frequencies and for different reasons. The magic of radio propagation can provide you with the occasional DX (long distance) catch or it can provide the avid student with a lifelong study of a very interesting field of scientific inquiry.

...And Skip's the Game

Well, what causes normally short range or line-of-sight radio waves to end up thousands of miles away from their intended targets? In a word, *skip*. Slang actually, skip comes to us from earlier days in the CB hobby. Today, amateur radio operators use the term to describe the bouncing of radio waves off the ionosphere.

Let's start with a brief description of skip. In the High Frequency (HF) bands from 3 to 30 MHz, it allows you to listen to international shortwave broadcast stations. The signals radiate from the antenna of, let's say, Radio Portugal, travel up toward the sky, and would go directly into outer space, if it were not for one thing—the *ionosphere*. This invisible layer of charged, or ionized, particles will not allow the radio waves to leave the earth's atmosphere. They are, instead, *refracted*, or reflected or bent, and bounce back down toward the earth at an angle that's dependent on the angle the signal hit the ionosphere in the first place. This angle is also determined by the frequency of the radio wave, as we will soon see.

Eye on the Ionosphere

So what exactly is the ionosphere, where is it located, and how does it work?

The ionosphere is composed of several layers of ionized electrons that surround the earth. They are caused by the sun bombarding our atmosphere with ultraviolet radiation. The ionosphere's ability to reflect radio signals is greatest during the daylight hours. During the day there are four separate layers of ionization that develop. These layers are called *D*, *E*, *F1*, and *F2*. The D layer resides at 40 miles above the earth's surface. The next layer, E, resides at an altitude of 60 miles. Both of these layers disappear at night. The two F layers, which reside at 120 and 200 miles in altitude, respectively, merge at night and become one layer.

Radio signals above 30 MHz tend to penetrate the layers of the ionosphere, an effect that increases the higher you go in frequency. This is why most VHF/UHF signals are limited to line of sight or short range. This is also the reason manned space flights and satellites use UHF and EHF frequencies. It ensures that the signals will penetrate the ionosphere and reach the spacecraft, which, in the case of the shuttle, orbits at between 200 and 300 miles above the surface of the earth.

Around the World in 80 Wavelengths

The seemingly random bouncing of radio signals around the world is what makes worldwide HF radio communications possible. The frequencies that bounce around most readily seem to be those between 12 and 18 MHz. The lower you go in frequency, the shorter the hops or skip distance in miles, thereby increasing the communication distance.

Now, depending on the frequency, time of day, and power of the stations involved, a radio signal can make multiple hops between the earth and the ionosphere. This can cause an unusual effect on foreign broadcast signals. At times you may hear what sounds like fading or a reverb-effect in the audio quality of the broadcast. This may be because you're receiving the signal from two different paths. For example, your station may be receiving the broadcast from the shortest, most direct path of a signal that has made a single hop from the transmitter to your receiver. In addition, propaga-

tion may be so good that the signal from the broadcast station is strong enough to make a long path, with multiple hops between the earth and ionosphere, to your station location. The signal is literally going completely around the curvature of the earth—the long way. Because of the multiple hops, the signal arrives at your receiver slightly later than the more direct path signal and gives you this eerie audio effect.

This brings us to a term called *MUF* (*Maximum Usable Frequency*). This is simply a method of determining the best frequency to use for a given target area. At different times of day and different seasons of the year, different frequencies will work better if you're trying to get a signal into a particular area of the world. Foreign broadcasters use this method, which explains why they're constantly switching frequencies throughout the day, depending on the target they are trying to reach.

What Does this Mean for Scanner Monitors?

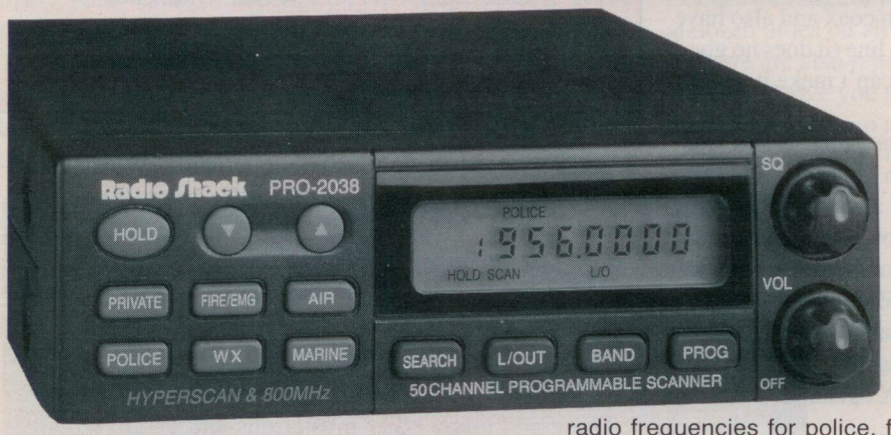
Though 3 to 30 MHz is the usual area we think of when we talk about skip, it can take place on any frequency up to 180 MHz, under the right conditions. This means our VHF low band, which runs from 30 or 50 MHz, can, especially in summer, provide some very exciting DX opportunities for scanner monitors.

Low band frequencies will reflect off the F2 layer of the ionosphere (at 200 miles altitude). Low band signals will also bounce back to earth in what is known as *Sporadic-E* (S-E) propagation. This unique form of E layer ionization occurs directly over severe thunderstorms. Storm cloud tops that reach 60,000 feet, or roughly 70 miles, often exhibit the same electron ionization as the ionosphere's E layer. This is, however, a small patch or cloud of ionization. It will reflect radio signals just like the other layers, with this difference: S-E usually consists of a single hop. The phenomenon usually occurs in the summer and lasts only a short time—hence the term "sporadic" E. The F2 layer and S-E will allow signals to be bounced up to 5,000 miles away, depending on frequency; 2,000 miles or more is common on VHF low band. That's a little better than the usual 50 miles you might normally expect out of direct path at these frequencies.

Transequatorial (*TE*) skip is another mode of propagation found in the 30- to 50-MHz low band. It usually occurs in the late afternoons during the summer months (spring and fall are the best times for most 30- to 50-MHz skip). It can be caused by F2 or S-E between the latitudes of about 30 degrees north and 30 degrees south of the equator. This range is not hard and fast, however. A much wider area regularly has TE skip, too; it's just more frequent in the lower latitudes of the U.S.

During the Central American wars of the 1980s, military and governmental radio communications from Central and South American stations were commonly heard in the U.S.

NEW! The home/mobile scanner preprogrammed with



2,193 frequencies to go!

This may be the most convenient scanner you'll ever use! The new RadioShack PRO-2038 zeroes in on local action right out of the box thanks to 2,193 preprogrammed radio frequencies for police, fire, emergency, aircraft, marine and weather services. And because you can power it from home AC plus vehicle 12VDC with an optional power cord, you can scan for active frequencies wherever you are. Great for travel!

PRO-2038 features HyperScan high-speed search and scan, 800-MHz and VHF air bands, 50-channel memory and lockout. You get a built-in speaker and detachable indoor antenna, plus jacks for an external speaker and antenna.

New PRO-2038 is easy to use and packed with features—made to order for novice and experienced scanner buffs alike. Get yours to go today! Only $199.99, only at RadioShack.

Frequency coverage: 29-54, 108-136.975, 137-174, 406-512, 806-823.9375, 851-868.9375 and 896.1125-956 MHz.

RadioShack℠

You've got questions. We've got answers.℠

during the summer DX season. Though there's somewhat less radio traffic from the area today, it's still a hotbed of activity that can sometimes be monitored.

Yet another unusual trait will be noticed on low band. It's called *backscatter* and is associated with F2 and S-E transequatorial propagation. Let's say, for example, that you're located in Houston, Texas. You happen to hear a station, which could be military, public safety, or another government agency, give a station ID. It gives its location as Jacksonville, Florida, or maybe Shreveport, Louisiana. How does this happen? Well, if it is backscatter, it happened like this: The same ionized patch of electrons in an S-E or F2 layer that can reflect your signal great distances in a single or multiple hop can bounce some or much of your signal directly back at you. Remember, geometry is at work here. The ionosphere is not so much like a mirror reflecting radio signals as it is an ocean of rolling waves that bend radio signals back down to earth. This means you will have fading, flutter, and other noticeable variations in the reflected signals. If the radio signal hits the end of a thick S-E cloud of ionization, you'll get as much backscatter as you will forward reflection.

Check It Out Yourself

So, what will you need to hear all this long-distance military, public safety, and industrial radio traffic on your scanner? All you really need is to connect your scanner to an outside antenna. Any will do, and you can even make your own. Three of the best commercially-made scanner antennas for DX are the all-band ground plane (#20-014) and the discone antenna (#20-013), both from Radio Shack, and the wideband vertical dipole by Channel Master. Next you'll need a quality coax cable. I recommend Belden coax and also have a preference for 9913 or similar low loss line (it does no good to have an outside antenna if the signal can't make it to your scanner because of cheap coax!).

I'd also recommend using a cassette recorder. If you want to receive QSL cards, or some other form of verification from the stations you hear on DX, you'll need a way of identifying them. A recorder may then be a must. You'll often miss clues that identify stations the first time you hear them, but will pick them up later on by replaying the tape. Moreover, if you're a real fanatic, you can even get a voice-operated cassette recorder that can be hooked directly into your scanner. This way you can search for and catch those elusive DX openings—without even being home!

You will also want to get some good reference materials to help you determine the type of traffic or the specific station you're hearing on a given frequency. You can usually tell by the frequency what type of service you're listening to (see frequency listing). But finding specific stations will require a reference book like *Police Call*, available from Radio Shack, or Tom Kneitel's *Top Secret Registry of U.S. Government Radio Frequencies*, available from CRB Research (Commack, New York).

Oh yes, there's one last indicator you should use when looking for VHF low band DX—your TV. If the low band is going to open for DX listening, so will TV channels 2 through 6. They use the 54- to 76-MHz band. If you see a cluster of new and snowy TV stations on these channels (which you should regularly check for if you're a true DXer!), then the race is on. Tune in the low band because you're bound to make some "hits."

Frequencies and Users

In most cases, you'll be able to tell what type of service you're picking up on your scanner by the frequency you're listening to. Here are some likely agencies with their associated frequencies.

Freq. Allocation (MHz)	Type Station	Freq. Allocation (MHz)	Type Station
30.000–30.560	Government	37.890–38.000	Public Safety
30.560–32.000	Industrial	38.000–39.000	Government
32.000–33.000	Government	39.000–40.000	Public Safety
33.000–33.110	Public Safety	40.000–42.000	Government
33.110–33.410	Industrial	42.000–42.950	Public Safety
33.410–34.000	Fire	42.950–43.190	Industrial
34.000–35.000	Government	43.190–43.690	Paging
35.000–35.190	Industrial	43.690–44.610	Transportation
35.190–35.690	Paging	44.610–46.590	Public Safety
35.690–36.000	Industrial	46.590–47.000	Government
36.000–37.000	Government	47.000–47.670	Pub/Industrial
37.010–37.430	Public Safety	47.670–48.550	Utilities
37.430–37.890	Utilities	48.550–49.590	Forestry, Petroleum
		49.590–50.000	Government

Low Band Sampler

Freq. (MHz)	User	Freq. (MHz)	User
30.150	Navy	36.700	Forest Service
30.300	Army	36.900	Test Flights
30.450	Army/Nuclear	40.100	Helo Freq
30.500	Army	40.170	USAF
32.320	White House Comm Van	40.210	Nat'l Park Serv
32.500	Army	40.500	Search/Rescue
32.850	USAF	40.970	Hwy/Safety
34.100	USAF	41.500	Army Helo
34.300	Coast Guard	46.750	Marine 1 (Pres Helo)
34.450	Coast Guard	47.420	Red Cross
36.300	Army		
36.550	Navy		

And There's More Still...

These and many other mysterious and exotic propagation modes are at work year round, not only on low band but well up into the 400-MHz range and higher. In the future, we'll look at some other fascinating aspects of radio. For instance, did you know you could bounce signals off the moon, the Northern Lights, or the tail of a meteor? Did you know a cold front could pick up a radio signal, carry it hundreds of miles, and dump it into a geographical area no larger than a half mile in diameter? Did you know that satellites have been heard when directly over the opposite point of the globe from your ground station? There's just no end to the thrill of radio. ■

Turn That Old Crystal Scanner Into A Useful Tool

Get that relic down from the garage shelf and turn it into a dedicated listening device.

By Chuck Gysi, N2DUP

If you've been a scanner hobbyist for a number of years, there's probably a usable relic in your basement or on a shelf in your garage. It probably served you well at one time, too, until programmable scanners became the rage.

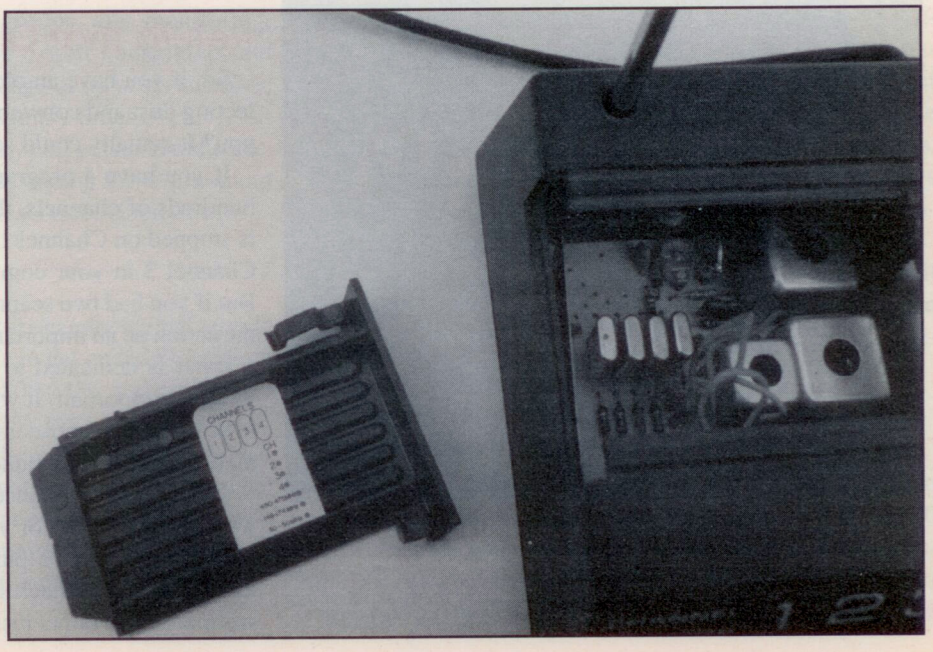
Crystal scanners have been around for a long time. The first ones came out in the late 1960s and offered those who monitored VHF or UHF transmissions new possibilities. Previously, a receiver could monitor only one frequency at a time. But when scanners were born, it added a new dimension to monitoring. Instead of being glued to a single frequency for hours on end, scanners allowed many channels to be scanned for action.

You can liken it to this scenario: Before TVs had remote controls, you pretty much tuned in a channel and sat down in your comfy chair. No channel surfing—unless, of course, you physically got up and walked over to the set and changed the channel. But with remote control, you can "scan" the TV channels for shows that look interesting. You don't have to get up and shuffle across the floor to change the channel. Single-channel receivers that were in existence before scanners required the listener to lock in on one frequency, either by a tunable dial or by manually switching between two or more crystals.

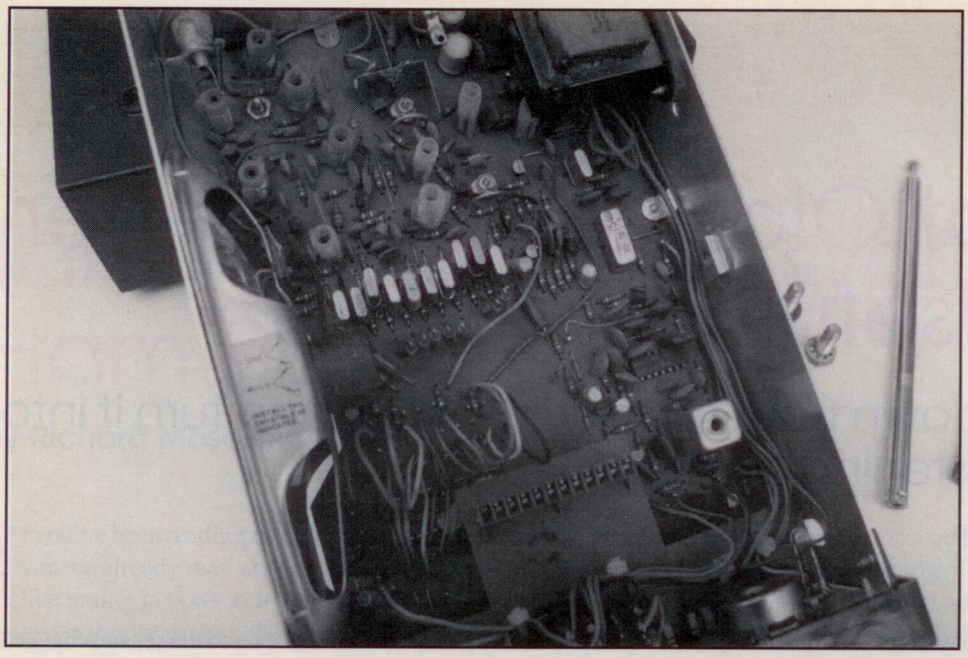
Crystals?

What are these things called crystals, and why do older scanners need them?

Crystals are thin wafers of quartz that are used to generate radio-frequency energy. They're usually encased in small



Some crystal scanners have little doors to access the crystal compartment. Note the decal on the removable door indicating how to plug in the wires next to the crystals for the VHF low, VHF high, or UHF bands. (Photo by Chuck Gysi, N2DUP.)

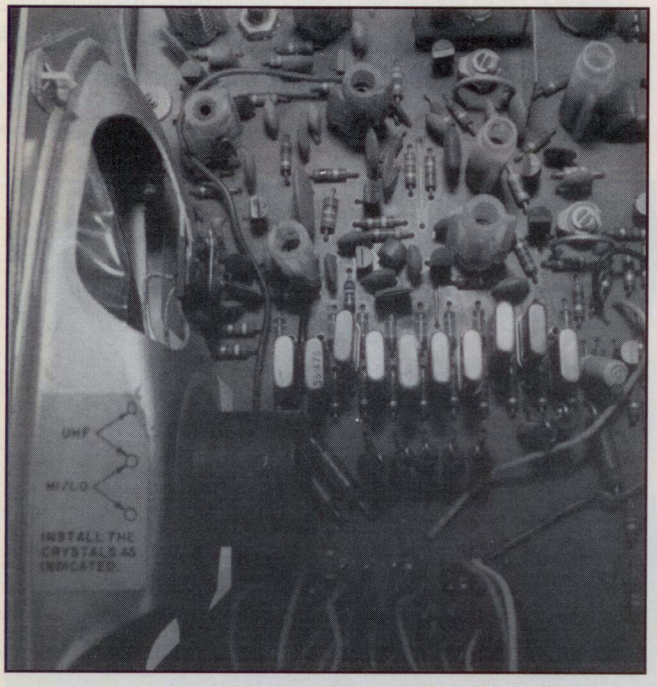


After removing the exterior case from a crystal scanner, look for the row of crystals plugged inside the radio. In this case, 10 crystals are just to the right of the speaker at the radio's left. (Photo by Chuck Gysi, N2DUP.)

metal housings, or "cans" and, for scanners, are typically about the size of small button batteries you'd install in your camera. Wire leads or studs protrude from the bottom and are connected to the faces of the crystal inside the can.

The operating frequency of crystals is determined by the way the quartz is cut and by its thickness. Thinner crystals result in higher frequencies, for instance. Because crystals cannot be tuned, those old crystal scanners created a unique problem: For every frequency you wanted to monitor, you had to plug a crystal into an internal socket. For serious scanner listeners, that usually meant a box full of these little devices, which ran in the neighborhood of $5 to $10 each.

When most crystal scanners had only about eight or 10 channels, you were somewhat limited in the number of frequencies you could scan, especially in light of the programmable scanners of today that offer hundreds (if not 1,000!) channels. If you wanted to change a frequency you were scanning, it usually meant breaking out a screwdriver and opening up the scanner and pulling out an undesired crystal and reinserting another. And, in some scanners, it may have meant reconfiguring some wiring inside the radio, too. That hardly makes it as easy as it is to change a frequency in a synthesized scanner of today!



Here's a closer view showing where the row of crystals is installed in the scanner. Note the decal on top of the speaker indicating how the crystals are to be plugged into the scanner, depending on their band. In this situation, crystals 3, 8, and 9 are UHF, while the rest are either VHF high or VHF low bands. (Photo by Chuck Gysi, N2DUP.)

Refurb that Old Relic

So, if you have an old crystal scanner sitting around collecting dust and cobwebs, what good could it possibly serve you? It actually could serve well, if it's still working.

If you have a programmable scanner that has dozens or hundreds of channels, think about this: When your scanner is stopped on Channel 181 and the action is taking place on Channel 3 in your community, you're missing the action! But if you had two scanners running, the chances of missing the action on an important frequency are lessened if the other scanner is dedicated to monitoring only those frequencies you find important. It will take the crystal scanner less time to scan through those important channels than the programmable scanner with hundreds of channels.

There's a good chance that old scanner of yours is loaded with crystals good for your community, too. But if it isn't, new crystals can be purchased from a variety of sources, including Radio Shack stores via special order. Most crystal scanners cover either just VHF low band and VHF high band,

or those two bands plus UHF. There are some older models, too, that may cover just one band. There even were models made just to cover the VHF aeroband in the AM mode.

Opening the Radio

First, remove the screws on the exterior of the scanner for access to the inside of the radio. Check to see if there's a trap door on the top of the scanner that may allow access to the crystal compartment without committing minor surgery. If the top of the scanner isn't removed easily, you may have to pull off the volume and squelch knobs from the front of the radio to slide the radio's chassis out of the exterior case.

When the exterior case is removed, look for a cluster of components neatly arranged or staggered in a row. You may find that the frequency is stamped or engraved on the top or side of the crystal. You should pull out each one and see if a frequency is indicated on the crystal. This will allow you to put together a list of what frequency is used for each channel. But how do you tell what crystal is for Channel 1 and which is for Channel 8? Look on the circuit board; there is probably a number printed next to each crystal indicating which channel it is for.

If a crystal doesn't have a frequency stamped or engraved on it, don't panic. You may be able to figure out what frequency it is by monitoring it. For instance, if it sounds like your local police dispatch frequency and matches up with the transmissions on your other scanner, then you've pegged what frequency the crystal is. Just be sure to use a permanent marker and neatly print the frequency on the crystal when you determine what it is.

In some crystal scanners, jumper wires have to be plugged into the circuit board next to the crystals, depending on the band for that crystal. The easy way to install these jumper wires is to put all your VHF low band crystals together, followed by VHF high band and then UHF. There should be some indication on the circuit board as to what jumper should be installed in which jack on the board. Some scanners may have a decal somewhere inside the scanner, too, showing the configuration necessary.

Upon opening the scanner, you may also encounter small switches that show "lo," "hi" and "U." For each crystal, set the switch to the band for the desired frequency and you're all set for that crystal to work in that radio!

Cleaning

While the radio is pulled apart for your crystal inspection and possible replacement, consider cleaning the radio, especially if it has been sitting around. A solution such as Fantastik works well in cleaning accumulated dirt off the case and facade of the radio and also helps shine chrome parts. Pour a little of the solution on a paper towel and rub into the surface to clean the metal.

It also wouldn't hurt to blow dust and dirt from inside the interior of the radio while the case is removed. Be sure not to touch anything inside the radio, though, if it's plugged in. Some older scanners may smell somewhat funny when they're plugged in after long disuse because the components warm up and heat dust that has accumulated inside the radio.

It's possible you'll be able to shine that old scanner to look just like new!

Finding Old Crystal Scanners

If you don't happen to have a trusty old crystal scanner sitting around your home collecting dust, don't fret. They're so easily found you'd be amazed.

If you go to hamfests or radio swap meets, you'll typically find several old crystal scanners for sale. But you should avoid buying one unless it is from someone in your own community and here's why: If you can use the crystals already installed in the scanner, minus a few that may need to be replaced, you'll save a lot of money. Remember, each crystal will cost you between $5 and $10, unless you can find those components for sale used, too.

If you can buy a scanner with all your local channels installed in crystals, you'll save the $50 to $100 it would take to buy crystals to equip the unit!

Other good places to find old crystal scanners are local flea markets and garage sales. If you can find a scanner for sale at a garage sale in your community, it most likely will contain crystals for local frequencies of interest, again saving you the expense of re–equipping it, plus you probably can plug it in and test it before making an offer.

The thing about garage sales is that either the sellers want too much for the scanner (they think they can recoup the $200 they invested in it a decade or two ago), or they have a price on it that is worth negotiating. You shouldn't have to pay more than $25 for a crystal scanner in good operating condition. If the seller is asking $35 or $40 for the crystal scanner, offer $20 or $25. That's a fair price for a piece of radio gear sitting around for a number of years. If the seller hedges, tell him you'll stop back later before the garage sale is over to see if he'll reconsider your offer then. But don't expect the radio to still be there if the price already is somewhat low.

Make your offer and don't budge. If the seller tries to bring your offer up $5, it probably isn't worth haggling over, especially if the scanner has crystals of local interest.

You probably don't want to take the scanner apart while visiting someone's garage sale to determine what crystals are installed. But if the seller lets you plug it in to test it, you'll know if local activity starts coming in over several channels over a period of five to 10 minutes. It's a gamble, but if you can get it for the right price, you may come out ahead of the game.

Antennas

On most older crystal scanners, you have the option of using a telescoping antenna that usually goes through the top of the case to a screw on the circuit board inside the radio, or you can use the Motorola jack on the back of the scanner for an external antenna. When an external antenna is plugged into the Motorola jack, the telescoping antenna is cut out, and there is no need to extend it.

To use the external antenna jack, you usually don't have to travel any farther than a nearby auto parts store to obtain a Motorola plug; they're the same type used on all automotive AM/FM radios. The center conductor of the coaxial cable (RG-58U cable is satisfactory for mobile use) is soldered to

Eleven Codes

11-06	Discharging of firearms
11-08	Person down
11-10	Take report
11-12	Loose rocks
11-13	Injured animal
11-17	Wires down
11-23	Vehicle traffic hazard
11-24	Abandoned vehicle, traffic hazard
11-25	Vehicle hazard
11-26	Occupied stalled vehicle
11-27	Suspect has felony record, not wanted
11-28	Rush registration info, driver detained
11-29	No records, no wants
11-40	Is ambulance needed?
11-41	Ambulance is needed, dispatch code (1, 2, or 3)
11-42	Ambulance not needed
11-43	Doctor needed
11-44	Dispatch coroner
11-47	Person injured
11-48	Provide transportation
11-54	Suspicious vehicle
11-65	Signal light out
11-66	Signal out of order
11-71	Fire
11-79	Traffic accident with injuries, ambulance dispatched
11-80	Traffic accident with major injuries
11-81	Traffic accident with minor injuries
11-82	Traffic accident with no injuries
11-83	Traffic accident with no details (usually Code 2 or 3)
11-84	Direct traffic
11-85	Send tow truck
11-86	Special detail
11-94	Pedestrian stop
11-95	Traffic stop
11-96	Leaving car to investigate suspicious vehicle
11-98	Meet with...
11-99	Officer needs help, EMERGENCY

Here's how to plug an external antenna into the rear of a crystal scanner. In this situation, the cable terminated in a common PL-259 connector, so a Motorola plug adapter was added to allow plugging in. Note there are two Motorola antenna jacks on the back of this scanner: the one on the left of the center of the radio is for UHF, while the other jack at the right is for the VHF high and VHF low bands. (Photo by Chuck Gysi, N2DUP.)

the inside of the tip of the plug, while the cable's braid should be soldered to the flanged part of the jack.

If you don't want to mess with Motorola jacks, and you already have an external antenna with a PL-259 jack installed on the end of the cable, use an adapter such as Radio Shack #278-208. This allows you to plug the cable into the back of the radio without having to solder.

Ready to Monitor

The scanner has been cleaned and you have a list of crystals inside the radio with the channels they correspond to. An antenna is ready to be plugged in. After checking to make sure the AC cord is safe, you're ready to put that old relic to good use again.

Plug it in and don't hesitate to turn the volume up a little louder than your programmable scanner with its dozens or hundreds of channels. Remember that this old radio will bring you the action on your most important channels. When the newer scanner is stopped on the dog catcher's frequency, your old relic can be bringing you news of a fire in your neighborhood or a major crime being committed downtown.

Let that old scanner be a workhorse for you. As long as everything works well, you've got a bargain. And the price was right, too! ■

In Review: The PRO-2035 Programmable Scanner

By Dave Marshall, N8OAY

The Radio Shack PRO-2035 is a programmable scanner covering 25 MHz to 520 MHz, 760 MHz to 824 MHz, 849 MHz to 869 MHz and 894 MHz to 1300 MHz. It replaces Radio Shack's PRO-2006 as their top-of-the-line base scanner. The PRO-2035 has some new features, plus an amazing 1,000 memory channels!

Its features include HyperScan, rotary tuning, priority channel, instant weather, memory backup, and scan delay. You also get 10 channel storage banks, monitor memory (up to 100 frequencies), auto store, tape out jack, and a lockout function. It offers two power options: AC power with supplied power cord or vehicle battery (with optional cord).

Let's take a feature-by-feature look at the PRO-2035. The best way to do this is through a "guided tour" of the keyboard, which controls all of the functions of the PRO-2035. The front panel is divided into three sections. On the left is the ON/OFF/VOLUME and SQUELCH knobs and two keys, on the right is a large tuning knob and six more keys, and in the center is the back-lighted LCD display and four rows of six keys.

How Does It Perform?

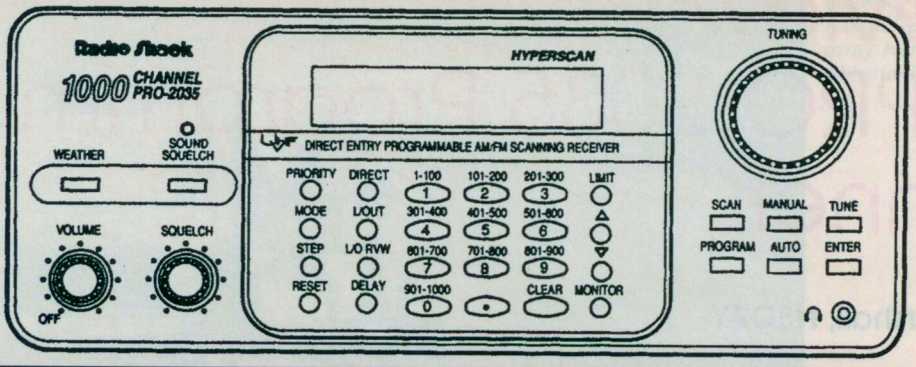
The PRO-2035 is a high-performance scanner designed with the serious communications listener in mind. It's sensitive enough to pull in the weakest of distant signals, yet, with use of the 10dB ATT switch, it can reject most interference from nearby high-powered transmitters. The audio quality is greatly improved over previous Radio Shack models and those of other manufacturers, too. Audio output is a whopping 1.8 watts into an 8-ohm speaker. Scan/search speed is a fast 50 channels per second.

The display uses a new type of back-lighting that is much easier on the eyes than previous models. The bright display can be read from greater distances and from angles further off

The PRO-2035 is Radio Shack's top-of-the-line base scanner and has an amazing 1,000 memory channels!

PRO-2035 Specifications

Sensitivity: AM (20dB S/N with 60% modulation) 25–520 and 760–1000, MHz 2 µV; 1000.005–1300 MHz, 5µV; NFM (20dB S/N at 3 kHz deviation) 25–520 and 780–1000 MHz, 0.5µV; 1000.005–1300 MHz, 3µV.
Selectivity: AM ±6 kHz –6dB, ±12 kHz –50dB; NFM ±10 kHz –6dB, ±20 kHz –50dB; WFM ±150 kHz –6dB, ±300 –50dB.
Scanning Rate: Up to 50 channels/sec.
Search Rate: Up to 50 steps/sec.
Audio output: 1.3 W nominal.
Weight: Approximately 4 1/2 lb.
Dimensions: Approximately 3 1/2" x 9 1/8" x 8 1/16" (HWD).



The front panel of the PRO-2035 showing controls for the scanners many features.

ON/OFF/VOLUME—Turns the scanner on and off, and adjusts the audio volume.

SQUELCH—Adjusts the scanner's squelch. (For those not familiar with the operation of communications radios, the SQUELCH control allows you to silence the radio when a signal is not being received.)

WEATHER—One-touch control to scan through the pre-programmed NOAA weather channels for up-to-the-minute local weather information.

SOUND SQUELCH—Allows the scanner to continue to scan if it stops on a dead-carrier signal with no voice or other sound. (Note: this feature will not allow the scanner to pass over "birdies" which are internally generated signals that are nothing but noise.)

PRIORITY—Toggles the PRIORITY function on and off. Any one of the memory channels can be programmed as the PRIORITY channel. When PRIORITY is on, the scanner automatically checks the specified channel every two seconds for traffic, even if it is in a bank that is not currently in the scan sequence. This way you won't miss anything on that one most important channel.

DIRECT—Starts a direct frequency search up or down from the frequency showing on the display.

LIMIT—Sets the "upper" and "lower" frequencies for a search range. Searches let you find unknown frequencies that are in use.

MODE—Switches the receiving mode between AM, Narrow FM, and Wide FM (for FM broadcast and TV audio).

L/OUT—Locks out individual memory channels so they will be passed over when scanning.

↑ and ↓ —Runs a search up or down from the starting point.

STEP—changes the frequency step in searches from between 5, 12.5 or 50 kHz.

L/O RVW—Reviews memory channels that have been locked out.

RESET—Resets the scanner to the default receive mode and search steps.

DELAY—Toggles on or off a two-second delay for each memory channel so that replies to conversations will not be missed.

CLEAR—Erases an incorrect entry if pressed before pressing the ENTER key.

MONITOR—Accesses the special monitor memory channels. Active frequencies found while searching can be temporarily stored in these MONITOR channels for later transfer to the regular memory channels.

1-0—Each of these keys serves multiple functions. They are used to enter a frequency or channel number, or when scanning to add or delete memory banks from the scan sequence. The 1,000 memory channels are divided into 10 banks of 100 channels for ease of use. Bank 1 comprises channels 1–100; Bank 2 channels 101–200, etc.

SCAN—Activates the scanning function

MANUAL—Serves two functions. Pressing MANUAL while in the scan mode stops the scanning. In the manual mode, pressing MANUAL advances to the next memory channel, or to a specified memory channel when pressed following the pressing of the number keys.

TUNE—Controls the tuning knob to scroll through memory channels or a manual frequency search.

PROGRAM—Activates the memory programming function.

AUTO—Lets you automatically program frequencies found while searching unused memory channels (bypassing the MONITOR function), or to move a block of frequencies from one bank to another.

ENTER—Enters frequencies into the memory channels.

ATT (located on the back)—Inserts 10 dB of attenuation in the received signal to reduce interference from strong nearby transmitters.

DISPLAY—The back-lit LCD (Liquid Crystal Display) shows the frequency and channel number in use and has indicators for most of the scanner's functions.

That concludes our "guided tour." Now, let's get down to the nitty-gritty.

to the side than other scanners. The CPU is programmed to accept any valid frequency that the user wants to program (some models will not accept some valid frequencies). As an example, 163.9125 would be accepted by the PRO-2035, but other products might round it off to 163.910, which is close enough to receive properly, but can confuse some people into thinking that the scanner might be defective.

The PRO-2035 retails for $449.95 at Radio Shack. ■

Handheld Or Base/Mobile? Which Scanner Is Right For You?

By Steve Adams

So the excitement of hearing events in real-time, unedited and uncensored, has piqued your interest? When police officers pick up their microphones, you want to hear the action! Now you're faced with an important choice...which scanner should you buy?

Making an Informed Choice

Scanning is an individual pursuit, done at the desk, coffee table or in your vehicle. Without more experienced hobbyists to talk to, many new scanner enthusiasts are left to trial and error, or may even lose interest altogether because they can find the needed information. Buying a scanner can be a difficult decision. There are handheld, base/mobiles, 800 MHz, 20, 100, 400 and 1,000 channel models. Which one is right for you?

Let's first take a look at some scanner basics. Then we'll examine their major features, with an eye toward your own specific scanner needs, to help you make a much more informed choice!

A Little about Scanners

Standard AM/FM radios must be tuned to each individual frequency or station. They operate within the frequency ranges of AM/FM broadcasts. Scanners are radio receivers that can tune a broad spectrum of signals.

A scanner stores many different frequencies or stations in its memory. These can be police, fire, business, aircraft, or other frequencies of interest. The scanner tunes each frequency in the order it is stored, stopping on frequencies with activity. It starts scanning again once activity has ceased. After sampling all frequencies stored in its memory, it starts over, sampling them again.

How Are You Going to Use Your Scanner?

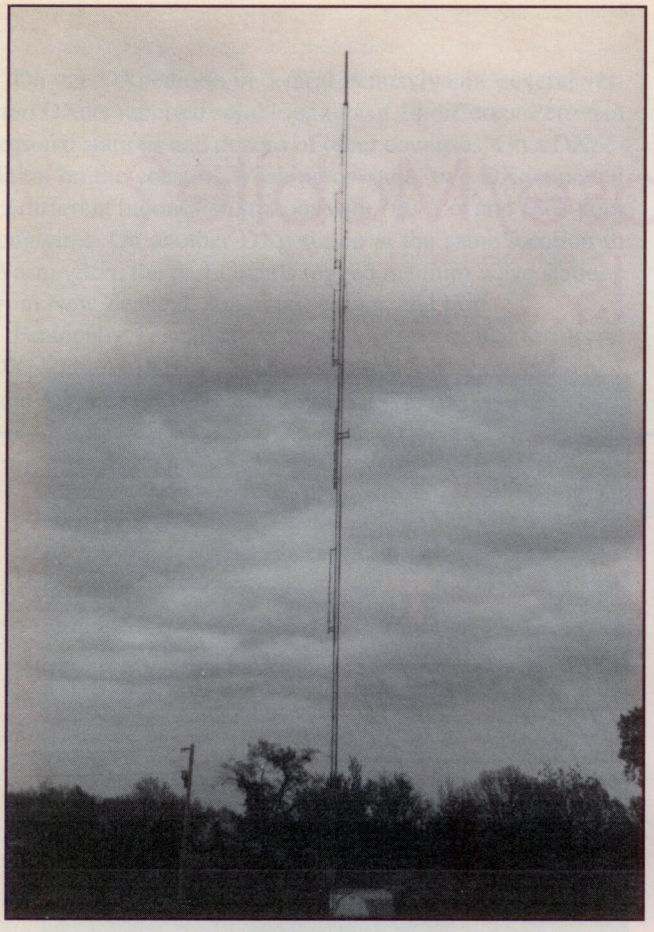
Most hobbyists listen to police and fire calls, usually from their homes, to remain informed. Others use them in their work. Public safety personnel monitor their departments, while truckers and other professional drivers monitor the weather and road conditions to help them navigate the highways. Television stations find breaking news stories for their news crews.

The PRO-43 handheld scanner features 200 channels. Its HyperScan zips through programmed channels at 25 channels per second and searches frequencies at 50 channels per second!

Knowing beforehand how you'll be listening to your scanner, and where you'll be doing your listening, will help you choose the correct model.

Do You Need a Handheld or Base/Mobile?

Handheld scanners are self-contained, compact, and easily carried in a briefcase, glove compartment, or large clothes pocket. They carry their own power supply in the form of rechargeable batteries or battery packs that can be used over



Many public service agencies use repeaters and high towers to give them wide coverage, especially for mobiles. Even with the modest rubber duck antenna provided with scanners, you'll usually be able to hear these repeaters.

It's a good idea to buy a scanner you can "grow into." All too often folks buy a scanner with just enough channels or features they need at the moment, only to discover a few months later that, for example, listening to military aircraft or other bands can be extremely exciting. (Photo courtesy Department of Defense.)

and over again. Rechargeable batteries are designed for operating for 5-8 hours per charge. Some use ordinary alkaline AA batteries. Many handhelds even have power jacks that allow them to operate from both 115 Vac and from the 12 Vdc in your vehicle, while keeping the battery pack fully charged. It's no wonder that most scanners sold today are of the handheld variety.

The base station scanner is a larger model, designed to operate permanently from your desk, and uses standard house current. Some with an additional 12 Vdc power capability can be permanently mounted in your vehicle. They're known as base/mobile scanners. These larger scanners are full-featured with larger displays, controls, a better speaker, and are designed with ease of operation in mind. They don't have any internal battery, but most do have a 9-Vdc "battery backup" that keeps the radio's memory from being erased during power interruptions.

Let's look at some of the basic scanner features.

Creature Features

• *Memory Capacity*: This refers to the number of frequencies that can be stored in the scanner (also called channels). Many low-end scanners have 10–20 channels, while upper-end scanners have 400 or even 1,000 channels.

Scanner memories are partitioned into "banks" of channels. A 100-channel scanner may have 10 banks of 10 channels, while 400-channel scanners usually have 10 banks of 40 channels. Each bank of channels can be turned on or off. Experienced users store related frequencies by banks or events, so the scanner can be configured with the touch of a button. Those who scan while driving often set up banks of channels according to the areas they will be traveling through.

How many channels do you need? Well, even small police departments use several frequencies: dispatch channels, inquiry channels (checks for wants/warrants), car-to-car channels, tactical and mutual aid channels, and more. If you add in nearby communities, fire, paramedics, news crews, airport crash crews, state and federal agencies, and military bases, you can quickly fill 100 or more channels. Decide first how many different types of communications you may be interested in monitoring and how busy an area you live in or travel through.

• *Frequency Range*: Public safety agencies, aircraft, business, and the military all use different frequency bands. To

hear them all, you'll need a scanner that covers those portions of the frequency spectrum. Many police and fire departments, as well as businesses, are upgrading their communications to 800 MHz systems and even higher. Anyone buying a new scanner should seriously consider buying one with 800 MHz capability.

• *Scan Speed*: This is the number of channels sampled per second. If you are in the heat of battle, trying to follow a high speed pursuit through several jurisdictions and frequencies, this feature may be very important to you.

• *Antennas*: Does the scanner have a BNC connector? Most antennas come in the BNC format. Using adapters increases signal loss and often makes life more complicated. You should get good reception with the installed rubber flexible antenna (rubber duck) for nearby signals. Accessory antennas are generally designed and tuned for particular sections of the frequency spectrum. Wide band antennas claim to work throughout the spectrum. Some do, some don't. Try them on your scanner first, if possible. Tuned amateur radio antennas can be used with great success for nearby public safety listening. Cellular phone antennas work well for the entire 800 MHz band, but they are in the TNC format, which means purchasing an adapter.

Roof or window-mounted antennas for your car and outside antennas for your base station mean you'll have to be concerned with routing a coax cable to your scanner. And, in the case of base antenna installation, you MUST be concerned with proper antenna installation—including grounding! Generally, the longer the cable, the higher the signal loss. Use high quality cable to get extra performance from your outside antenna. Also, the higher you mount the antenna, the better it will "hear"! Keep it and the cables away from potential noise sources, such as fluorescent lighting, motors, and other electrical equipment.

Many public safety agencies use repeaters mounted high on buildings or mountains to increase the strength and range of their signals. You may want to use an antenna specifically designed for a band that has weaker signals, while still being able to pick up the stronger repeater signals. In a pinch, amplified television or FM radio antennas may work, but you must use a small matching transformer and an adapter to make it BNC-compatible.

Read some of the books and magazines which deal with antenna theory, selection, and construction. Your reward will be tuning in many of those elusive weaker and distant stations! CAUTION: When working with antennas, extreme care must be exercised to prevent electric shock and equipment damage. Read and follow ALL instructions carefully. Seek advice from a qualified technician or your local Radio Shack store.

• *Display*: Most modern scanners use LCDs (liquid crystal displays) that are easy to read and use little precious battery power. Check the illumination function in the dark, if possible, to ensure it's bright enough to meet your needs. If you are using your scanner in a darkened vehicle at night, this might become very important. Other display features include the channel number and frequency stored in that channel, banks, delay and priority on/off. These should all be easy to read and understand.

Featuring high-speed scanning, 10 banks of 10 channels each, for a total of 100 channels, and including 800 MHz coverage, the PRO-25 could be just what you need in a handheld scanner.

• *Search*: This function lets you look for active frequencies within a frequency band or range. By entering upper and lower frequency limits, you're telling the scanner to stop at each active frequency within those limits. Some enthusiasts never use this function; others use the search function to look for frequencies not found in the books! Many agencies use frequencies other than those listed and assigned to them. You might find undercover operations on animal control frequencies, drug task forces on road maintenance channels, etc. To many, this is the essence of scanning!

Many scanners will allow you to store the active frequencies you find right into a memory channel. This is called the "monitor" function. The Radio Shack HyperScan feature gives you search speeds of up to 50 frequencies per second, allowing large areas of the spectrum to be searched by the scanner very quickly.

• *Lockout*: This allows you to bypass or lockout a channel without having to clear the data you've previously stored

there. You can unlock it later and start scanning it again with the touch of a button. "Lockout review" lets you see which channels you've locked out without having to cycle through hundreds of channels manually.

• *Delay*: After each transmission has ended, you may want to enter a 2–3 second delay, allowing you to hear both sides of a conversation. This delay can be put on any or all channels. This is an important and worthwhile feature found on most scanners.

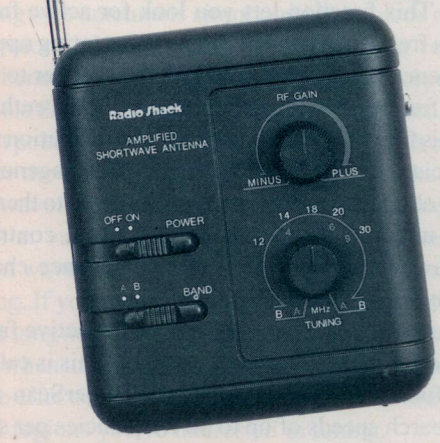
• *Keypad Lockout*: Usually found on handhelds, this switch or button disables all keypad functions. It prevents unwanted button action that might accidentally clear memories or switch the scanner to an unwanted mode. It's a nice feature, but not absolutely necessary.

• *Priority Channel*: If you want to keep watch on a channel of high interest, you'll want a scanner with this feature. When priority is engaged, the scanner will cycle to that channel every few seconds, regardless of where it was in the scanning cycle. This can be very useful for public safety personnel who monitor their agency, or for business people who monitor their company frequency.

INDOORS

Amplified antenna packs a punch!

Shortwave fans—hear more stations, more clearly! This compact, 9V battery-powered antenna amplifies signals up to 20 dB for reception that rivals outdoor longwires. Its tunable preselector *peaks* your selected frequencies and *rejects* unwanted ones, dramatically improving reception of weak signals and giving already-strong stations crystal clarity! Plugs into radio's external antenna jack, tunes 4-30 MHz. With 29" telescoping whip. Just $29.99—great value!



WE BRING YOU THE WORLD.
RadioShack.SM

• *Squelch*: This control adjusts the receiver threshold to eliminate static and atmospheric noise, but can pass the tiniest signals through, depending upon the setting. "Sound Squelch" in the PRO-2035 base/mobile scanner helps the scanner from locking up on frequencies with open carriers, data channels. and "open mics."

• *Output Jacks*: These consist of earphones, tape or audio jacks, and even computer interfaces. If you intend to use earphones, make sure you get adequate volume, since some scanners have a decreased audio signal when an earphone is used. Make sure you factor in vehicle or background noise, too. A tape recorder or audio jack allows you to record and preserve the action. Test a voice- or signal-activated recorder to make sure the signal will drive it properly. Later on you can play back those high speed pursuits for your friends!

Some serious scanner users hook up their personal computers, controlling their scanners by a program, completely unattended. If you intend to use these features, or think you might at some later date, you'll need one of the top-of-the-line scanners designed for computer interface. With that kind of investment, you will want to spend some time with your dealer testing each function, making sure you understand the capabilities and limitations of your purchase.

• *Weather (WX)*: This function automatically scans the National Oceanic and Atmospheric Administration (NOAA) frequencies (162.4 to 162.55 MHz) for the station in your area. This is a nice, but often unnecessary, feature since you can allot one channel in your scanner for weather.

The Big Buying Decision

It seems prudent to buy a scanner that you can grow into. Features and capabilities that you don't currently use may become necessities once your competence and interest grows. My personal recommendation is that your first scanner should probably be a handheld, with 100-200 channels, and 800 MHz capability, such as the PRO-25 or the 200 channel PRO-43. You should get rechargeable batteries and both the AC and DC power cords. These are full-featured scanners with high scan speeds, lockout, and priority!

Don't Forget the Frequency Guides

You'll be ready to start scanning immediately, so pick up a copy of the *Police Call* and *Beyond Police Call* guides. Many other fine publications that include frequencies for your area can also be found at your local Radio Shack dealer or advertised in *Popular Communications* magazine, the *Popular Communications Communications Guide*, *Monitoring Times*, and related publications.

Now go join a scanner club and subscribe to scanner magazines to keep up-to-date on new frequencies, products, and techniques. Happy scanning! ■

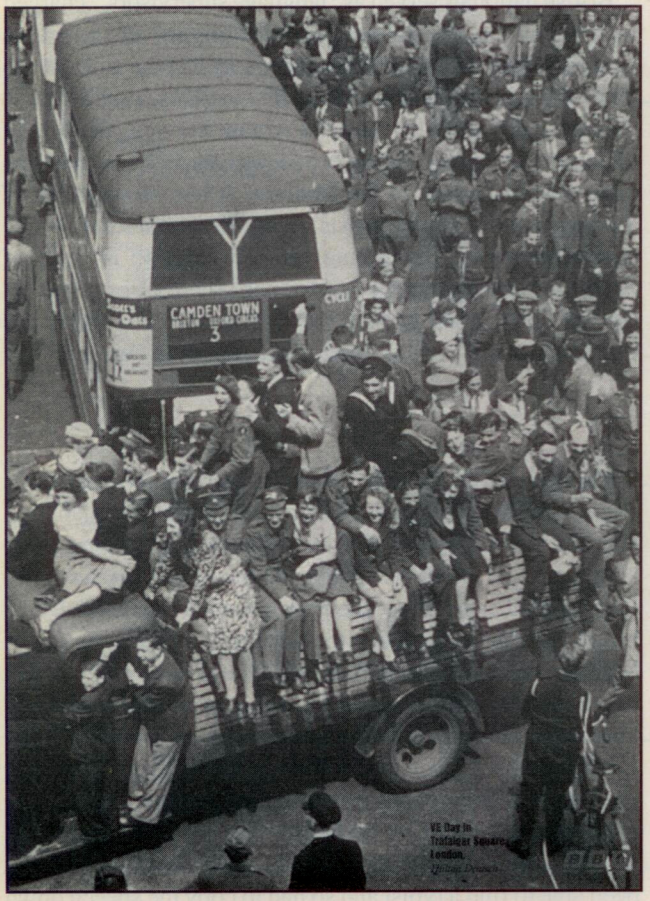
"V" For Victory— The BBC In World War II

A broadcasting giant makes its mark on a world in turmoil.

By Gerry L. Dexter

Would the Allies have won World War II if there had been no British Broadcasting Corporation? Probably. But the BBC was such a vital part of the war effort, especially in Europe, that it seems very likely that victory would have come much later, and at a significantly greater cost in human suffering, money, and materiel.

As the seeds of war began to sprout in the late 1930s, the BBC was quite unprepared for the role it was to assume. Nazi propaganda stations had begun broadcasting on shortwave in 1933, beaming German and English to the U.S., Hindustani to India, Afrikaans to South Africa—even Gaelic to Scotland. By 1935, the Italians were making propaganda hay, denouncing "British imperialism" in broadcasts to the Arab world where Britain had significant interests.



VE Day celebrations in Trafalgar Square, London. (BBC photo.)

Who's in Charge Here?

Some BBC higher ups were not eager to get involved with foreign language shortwave broadcasting because they were concerned about the propaganda factor—believing it would detract from the quality image the "Empire Service" had achieved. Turf wars over influence or control of the BBC's foreign language programming continued virtually through to the end of the war, though with minimal success. The Ministry of Information assumed general supervision of both domestic and foreign broadcasting, but the BBC was largely able to cling to its independence in its choice of what was broadcast. Various departments, such as the Political Warfare Executive, "Electra House," (the agency charged with Britain's black propaganda effort), and others tried pulling the BBC's rope.

There were attempts to get the BBC to report only positive news, but Lord Reith, the BBC's first Governor General, insisted the foreign services have the same freedom from government control the BBC enjoyed domestically. Hugh Greene, in charge of the German service, said after the war,

> "We were not merely being quixotic in following a policy of telling the truth. If we were right to foresee a long war, the time was bound to come when the tide would turn and we should have victories to report. The audience in Germany and in the German forces, having heard us talk frankly about our defeats, would believe us when we talked about our victories."

That, of course, is exactly what happened, and that early philosophy helped build the BBC's reputation as the world's

Throughout the war, the BBC insisted on accurately portraying world events within their foreign services. (BBC photo.)

most authoritative and unbiased news source—a reputation it still holds today.

But the BBC had acquired its stiff backbone rather late in the game. Some 50 years after the war, the British press and the BBC itself revealed that, for a time, the BBC had allowed Britain's pre-war, appeasement government to dictate many of its programming choices. Programming critical of Hitler or Mussolini was pulled off the air, Winston Churchill was denied air time. Even news of German and Italian aggression was toned down. But all that changed with the outbreak of the war.

Growing Fast

By the time Britain went to war, the Nazis had gained control of a number of powerful radio stations, and, in addition, were jamming the BBC's broadcasts with every imaginable kind of noise. The BBC had only nine shortwave transmitters (at Daventry, in Northamptonshire), most of insufficient power to provide the needed coverage and combat the Nazi jamming effort. At one point the Germans were devoting more money and effort to jamming than to their own broadcasting! Beyond the need for additional transmitters, there were worries about the vulnerability of having them all in one place.

It took upwards of 18 months to add four 100-kilowatt transmitters at a new site in Rampisham and another four at Daventry. Later, still more transmitters were added at Woofferton and Skelton (and nearby Cumbria). Among other medium and long wave frequencies in use was 1149 kHz, over which the European service was beamed simultaneously from transmitters operating in three different cities—a move the Royal Air Force had insisted upon to keep enemy bombers from using any one transmitter as a navigational beacon.

Beginning in 1941, the Empire Service went through several name changes—the General Overseas Service, Overseas Forces Program, General Forces Program—eventually becoming known as the World Service. (The BBC dropped that term a year or so ago and went back to individual services for various parts of the world.) The broadcasts to Europe were split into a separate service, as were those for North America. The latter reflected the importance Britain placed on persuading a still neutral America. Canadian announcers were hired for the North American service. Broadcasts stressed British-American unity and were tailored to American listening tastes. The famous "Radio Newsreel" program was originally created as something more in the style North American listeners were used to. A separate service was also established for Latin America, an area where German propaganda was especially active. All domestic programming was made part of the Home Service.

By 1944, some 600 people were working on the BBC's wartime broadcast effort, producing 44 hours of programming each day in 24 languages.

British nationals served as "language supervisors," charged with seeing that the translations from English into a foreign language were accurate. The supervisors had the authority to "kill" the mic during a broadcast if something went awry.

First to go on the air was the Arabic Service, attempting to counteract the damaging broadcasts the Italians and Germans were beaming to the Mideast. A son of the King of Yemen was one of the guests on the first broadcast, which normally featured 15 minutes of news and 45 minutes of music. In keeping with the newly established policy of reporting the news, good or bad, the first newscast reported the execution of an Arab by British authorities in Palestine.

Winging It

The first BBC French, German, and Italian broadcasts came in 1938 and were hardly a model of efficient planning. Hitler's claim to parts of Czechoslovakia made war seem imminent, and the British fleet had been called out. At 6 p.m. one September evening, the government asked the BBC to broadcast a three-language translation of a speech by Prime Minister Neville Chamberlain, which was to be given in just two hours! A frantic search for announcers fluent in these languages ensued. A German editorial cartoonist for the *London Daily Express* had to be summoned from a cocktail party to read the speech on the air in German. He'd never even been in a radio studio before! No advance copy of the speech was available. The simultaneous translator hadn't been able to find a typist and so had to copy the speech down in long hand as it was being delivered, then hand a completed

The BBC in North America

Listen for the BBC on the following frequencies (kHz),

Daytime: 5965, 6175, 6195, 9515, 9915, 11750, 11775, 11865, 15190, 17790

Evening: 5970, 5975, 6175, 7325, 9590, 9915, 11750

Note: Not all frequencies will be in use every hour and local reception conditions may mean some are inaudible.

Bush House, London, headquarters of the BBC foreign services since 1941. (BBC photo.)

page to the neophyte announcer. There were repeated long pauses of several minutes' duration as the announcer waited for the next page to be handed to him.

Once war was declared it became illegal for people under the Nazi regime to listen to the BBC. Indeed, the penalty if one were caught tuned into London was death! Nonetheless, millions listened. By one estimate, the BBC had 200 million listeners in Germany and occupied Europe! The Royal Air Force regularly dropped leaflets with the times and frequencies of BBC broadcasts.

Hier Ist England (Here Is England)

The German service was staffed by anti-Nazi Germans. Their names were never given out over the air. Most of the German broadcasters, like those of the other national services, had successful careers in their own countries as journalists, members of the professions, or active participants in film or theater.

"Broadcasting House," the original location, had been damaged by bombs in 1941, so the foreign services were moved to Bush House, in West Central London (still BBC headquarters today). The location was kept secret, even from members of Parliament. Initially, broadcasts were made from deep in the bowels of the building, in cramped quarters (christened the "Black hole of Tooting Bec"). The rooms had little ventilation and were filled with the output of the countless cigarettes and pipes smoked each day. New, aboveground studios were soon ready and eventually the foreign services occupied 15 of them.

General Charles de Gaulle was one of many leaders who broadcast regularly over the BBC. (BBC photo.)

In addition to news, programming focused on jazz and dance music—forms Hitler forbade on his radio stations. There was also an early morning worker's program and regular news of prisoners of war. Agents on the continent sent

sample radios to England where engineers would examine them. The BBC would then broadcast tips on how to improve reception on a particular brand or type. Instructions were also broadcast on how to build antennas that would reduce the effects of jamming.

One show, "Kurt and Willi," featured two fictional characters, one a naive schoolmaster, the other supposedly a member of the team of Josef Goebbels, the Minister of Propaganda under Hitler. The two met regularly in a Berlin cafe to have a drink and discuss such things as the various shortages being experienced in Germany. Ironically, "Willi's" last words on the last show in April, 1945, were, "I must go out now and see if there is any news." The very next item on the BBC was the announcement of Hitler's death!

The Ears Have It

The BBC Monitoring Service, which listens and reports on foreign broadcasts around the world, one day tuned in on a German station sending coded radioteletype. Engineers were able to break the code and discovered the transmissions were advance texts of official speeches and government pronouncements being transmitted for use by German-controlled newspapers and radio stations. The BBC's monitors began providing these texts, which were often read and commented upon over the BBC, well before their official release in Germany. Goebbels was convinced there was a British spy in his propaganda ministry!

"V" for Victory

It wasn't long before the BBC became a symbol of resistance throughout occupied Europe. Even Herr Goebbels complained of the "intellectual invasion of the Continent by British radio." The voices of such leaders as King George, General Charles de Gaulle, and, of course, Prime Minister Winston Churchill, as well as exiled leaders of Denmark, Holland, and other countries were heard regularly on the BBC. The famous "V for Victory" campaign urged listeners in occupied areas to scrawl a "V" anywhere they could. Churchill held up two fingers in "V" formation at every opportunity. The BBC's airwaves echoed the three dots and a dash of the Morse code symbol for "V," sounded on a timpani (and continued to do so for decades after the war). The campaign was the brainchild of the BBC's Belgian program director, Victor Laveleye, who realized that the French and Flemish words for victory both started with "V." The trouble was, the German word did too, and because of that the Germans were able to reduce the effectiveness of the campaign somewhat.

Spy Stuff

After its implementation in 1943, a transmitter nicknamed "Aspidistra"—a 600-kilowatt medium wave giant which had been purchased from RCA—was occasionally used by the BBC. The unit was also used by Britain's Special Operations Executive (S01) to interrupt German broadcasts by transmitting anti-Nazi comments. It also carried a number of clandestine broadcasters, claiming to be an independent station operating from occupied Europe.

British agents working inside enemy territory were caught, more often than not, and their radios used by the Germans pretending to be the now-captured agent. The low power of these radios (often barely 20 watts) frequently meant they were hard to "copy" in Britain. The idea of spotting a genuine agent by the sound of his "fist" (the individual way he sent Morse code) didn't work as well as expected because of the weak signals and the nervousness factor. Operators also often neglected to include security authenticators and those copying the signal in England too frequently just shrugged off that failure, rather than hearing it as a warning. The Special Operations Executive thus began making more and more use of the BBC as a means of sending coded messages, although this had limited practical use. These messages were largely just a way of alerting an agent to an impending operation or acknowledging the safe arrival of agents or material. Such messages to the French resistance were included af-

Frequency Spotlight: What's Going On Here?

Shortwave broadcasting stations are allocated within ranges throughout the high frequency spectrum. But you'll also find stations operating in many areas outside the so-called "official" bands, such as the range from 15.000 MHz. Let's take a look at what's to be heard and where.

15.000—Time station WWV operates here around the clock. If you hear a woman's voice, you've got WWV's sister station, WWVH, in Hawaii.
15.009—Voice of Vietnam. Try in the mornings.
15.020—All India Radio. Listed for 1300-1500.
15.030—Radio for Peace International, operating from Costa Rica. It's on this spot for most of the day.
15.050—All India Radio. Check around 1200 (in Chinese).
15.050—Radio Patria Libre, the station of the ELN rebels in Colombia, is sometimes active here. Reported at 1300, 1900, 2300, 0000, but it's very irregular.
15.060—Broadcasting Service of the Kingdom of Saudi Arabia. In Arabic until around 1500.
15.070—BBC, until mid-afternoons.
15.075—All India Radio. Try around 1100-1200.
15.080—Radio Bulgaria at 1100 and a relay of the Voice of America at 0600.
15.084—Voice of the Islamic Republic of Iran, 24 hours.
15.095—Kol Israel, in Arabic during the daytime.
—Far East Broadcasting Co, Philippines at 1015-1430.
—Radio Damascus, Syria, with English at 2005.

ter newscasts on the French service and often took as much as half the allotted time. On the eve of D-Day, the transcript of the personal messages ran to four pages!

For some time the BBC also broadcast a 10-minute news report in Morse code each morning. Using Morse made the content easier to pick up through German jamming. Members of the resistance would copy the news and publish it in their underground newspapers. One underground leader stated that the entire underground movement owed its existence to the BBC and the news it supplied.

The Pacific

Although the BBC's main broadcast efforts were directed at Europe, Africa, and the Americas, the war in the Pacific was not ignored. A fledgling Japanese service was set up about midway through the war, using relays in the U.S. and India, as well as direct broadcasts from England. The BBC admits its broadcasts to Japan were not nearly as successful as those to Italy and Germany. The BBC, in fact, was not at all eager to take on this challenge. Early on, when the suggestion for a Japanese service was first made, a government official thought that BBC broadcasts to Japan would be an important factor in keeping Japan out of the war. BBC executives responded by pointing out that Japanese citizens were not even allowed to own shortwave radios, much less listen to them. Only the highest officials enjoyed that privilege. To which the government replied that those officials were the very people it wanted to reach!

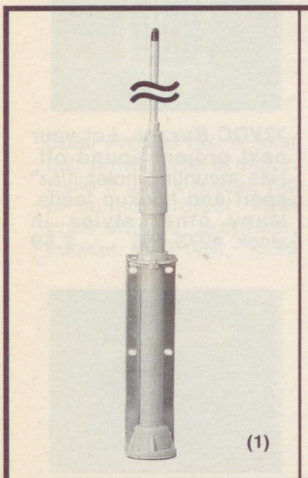
A Star Is Born

As the war progressed, the BBC's reputation grew in stature, along with the number of languages in which it broadcast. At the start of the war, the BBC was broadcasting in seven different languages; by war's end the total was an incredible 45! The station's technical facilities had experienced extensive growth in number and power as well. Most of the transmitter sites which were built during the war are still in use today. Unlike some of its first foreign language broadcasts, however, programs celebrating the end of the war in Europe were planned well ahead of time. When the historic moment arrived, the BBC began an unprecedented 10 days of special programming.

The BBC's record of excellence before and during World War II gained it the highest respect at home and abroad. That prestige was an important factor in the Corporation's being able to maintain its programming independence when the 1946 BBC Charter and License was drawn up. Today, 50 years later, the BBC's great reputation still stands. ■

Stay Tuned

For the latest information on the BBC, a North American edition of their *BBC Worldwide* magazine is available for $49.50/year. It offers program listings for the BBC World Service radio in English as well as for the BBC World and BBC Prime television channels. Contact: P.O. Box 76, Bush House, Strand, London, WC2B 4PH, England.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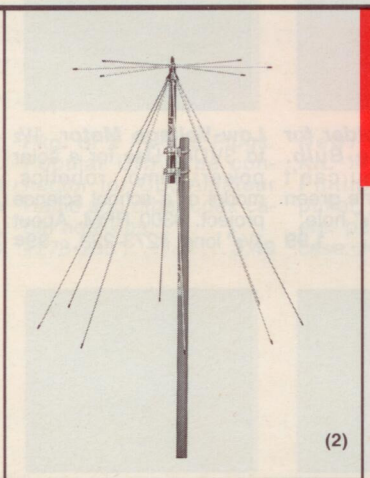
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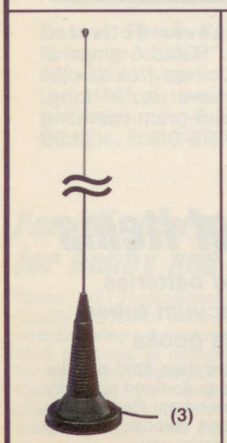
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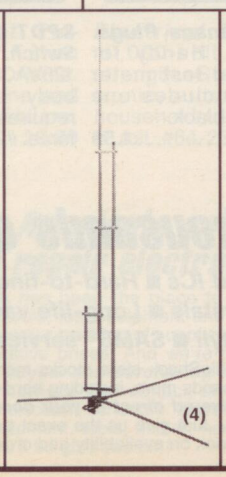
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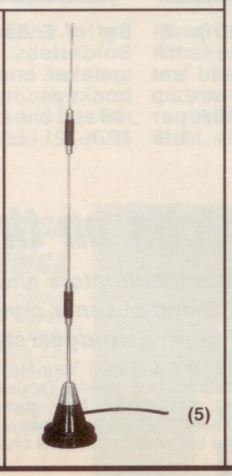
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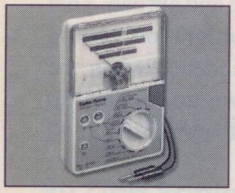

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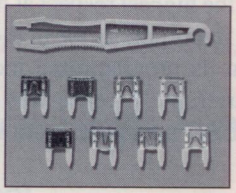

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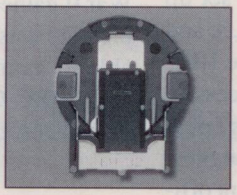

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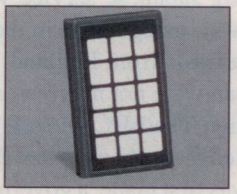

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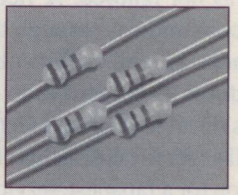

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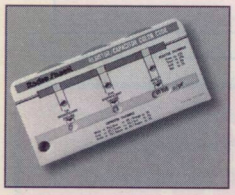

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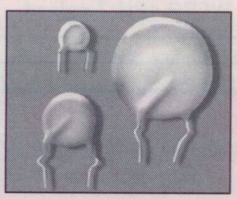

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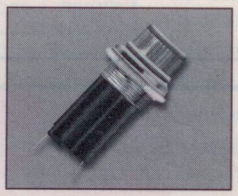

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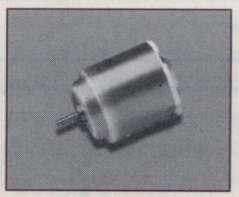

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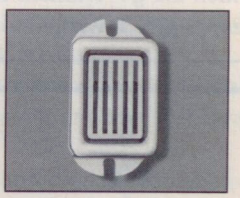

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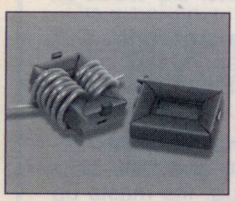

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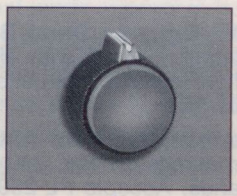

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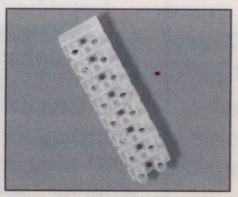

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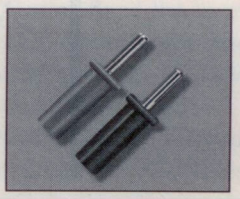

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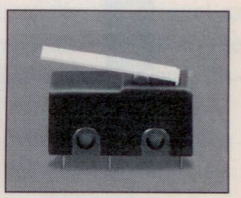

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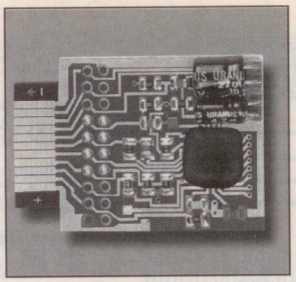

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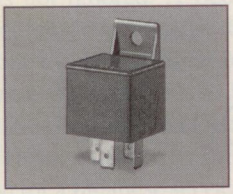

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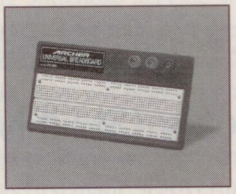

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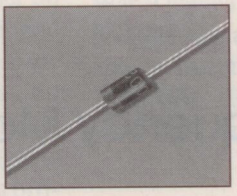

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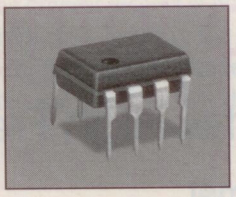

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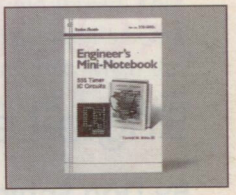

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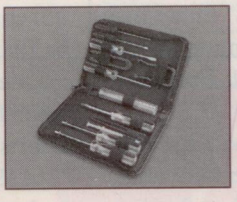

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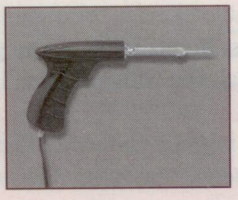

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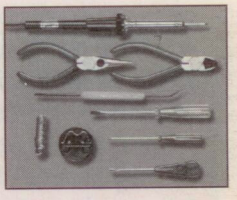

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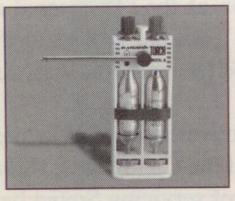

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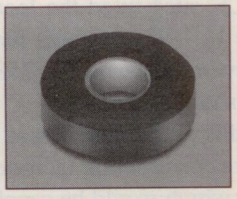

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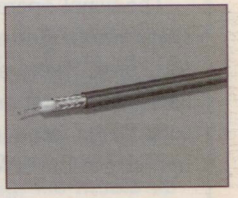

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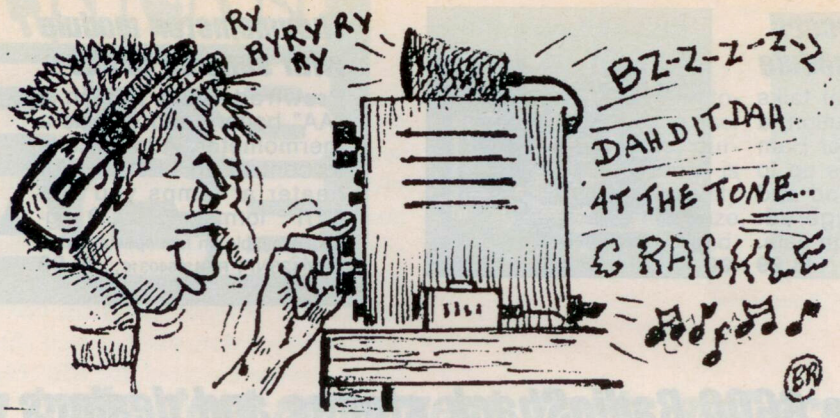


Radio Intrigue

Single-Letter High Frequency Markers (SLHFMs).

By Don Schimmel

Among the radio signals heard on the air are many mysterious communications. Within these pages of *Radio!*, we'll look at some of those communications and, where possible, give an explanation of them. In some cases, we'll only be able to offer "best guesses" rather than definitive conclusions. In this issue, we're going to discuss a type of utility signal, the Single-Letter High Frequency Markers (SLHFMs).

These signals were initially called SLHFBs with the letter "B" designating "beacon." As more and more individuals followed these signals, however, it became evident that beacon was not really an adequate term. Many in the hobby, including this writer, began using "marker" instead because it seemed to better cover the operational characteristics of the activity.

The usual operational mode appears to be a blind broadcast format. A single letter is repeated over and over for a long time. Every now and then, the repeated letter will cease and a data burst or groups of Morse code characters will be sent. Some frequency shift keying (FSK) has been observed in place of the CW (Morse code) or data transmissions.

A Long History

Some shortwave listeners (SWLs) can recall hearing a few of the marker signals in the early 1960s, and one believed he had heard either a "K" or "U" marker possibly in the very late 1950s. The point is that these guys have been around for a very long time.

Early loggings indicated "K" was initially heard on 9043 kHz. Exactly when is unknown, but it was probably late 1960s to early 1970s. Around the same time, rough direction finding (DF) bearings taken by SWLs showed Soviet territory as the location of at least some SLHFM transmitters.

With an increase in logged marker transmissions, it was discovered that there were clusters of them in different parts of the shortwave spectrum operating at the same time. Variations in frequency and transmission speed were also noticed. (Of course, one possible explanation for these changes could be fluctuations in the respective local power systems.)

Later in the 1970s, several hobbyists joined forces to pool what they knew about these transmissions and to plan future efforts to uncover additional details.

In 1977, "W" markers were being observed. It was quickly determined that this signal was originating in the western hemisphere. The frequency was 3584 kHz and within the 80-meter ham band. The signal caused interference to ham transmissions and the Federal Communications Commission (FCC) was brought into the picture. Radio DF shots from various FCC sites fixed the location of the "W" signal as Cuba. The U.S. Government made a formal protest to the Cuban Government and the 3584 kHz operation was discontinued shortly thereafter.

During this time frame, it was discovered that Soviet personnel were constructing facilities at the Cienfuegos, Cuba, naval base which would be capable of servicing Soviet ballistic missile-carrying submarines. The U.S. protested to the Soviet Union that the action violated the 1962 U.S./Soviet understanding which developed out of the Cuban missile crisis. The agreement stated that the USSR could not install any offensive weapons systems in Cuba. In the late 1970s, the construction was reportedly abandoned.

In the early 1980s, Russian Cyrillic letter marker "IO" turned up. The letter in Morse code is dot-dot-dash-dash.

Additional monitors were now reporting that the markers were ceasing and short messages of five-figure groups were repeated several times. This was followed by a return to the repetitive single-letter transmissions.

Best guesses about the SLHFMs involve the Soviet Navy. Shown here is the Russian Navy helicopter cruiser "Leningrad." (Official U.S. Navy photo.)

In the early part of 1983, the SPEEDX shortwave listeners club published a section of their "Reference Guide to the Utilities" which was devoted to a summary of SLHFM information. In 1984 and 1985, a series of articles on the subject authored by William Orr appeared in *Popular Communications* magazine.

In 1986 the FCC released some surprising DF results placing the origin of some SLHFMs as follows:

C—Moscow
D—Odessa
M—Moscow
P—Kaliningrad
S—Arkhangelsk
U—between Murmansk & Amderma
Z—Mukachevo

Additional DF work was conducted and propagation studies undertaken by various monitors, and most previously determined locations were confirmed. However, one earlier location, Kharbarovsk, was more accurately defined as Petropavlovsk, which is situated north of the earlier placement.

Some loggings were now showing that the short messages sent were frequently preceded by repetitions of callsign "UMS." This was reportedly the general Soviet Navy callsign used by the Petropavlovsk and Murmansk transmitter sites. Soviet Navy callsigns ROD and RMP plus others were being seen on the marker frequencies.

What Does It All Mean?

Most theories about these signals point to the Soviet/Russian Navy as the organization using the system. Speculations as to the purpose include transmissions of weather data, radio propagation data, navigational markers, or water level measurements of rivers, reservoirs, and lakes in the former USSR.

Several monitors strongly believed that at least one of the "K" transmitters was not located within the Soviet Union. A monitor in Maine reported that he had constant day and night reception of the "K" marker on 8790.5 kHz at good to excellent signal strengths. Propagation considerations definitely ruled out any possibility that this particular transmitter was located in the Soviet Union. One theory advanced was that the transmitter was on board a Soviet vessel.

Many of the SLHFM transmissions seem to come from sites where Soviet Naval components were located. I ran a computer search for the Soviet Navy at the local library and chose seven titles from the resultant listing. As I skimmed through the books, I noted any mention of Soviet Navy units and this is what I found:

Location	Unit
Kaliningrad	Baltic Sea Fleet Headquarters
Malyavr	Navy bomber base
Petropavlovsk	Naval base (missile-firing subs)
Severomorsk	Northern Fleet Headquarters
Sevastopol	Black Sea Fleet Headquarters
Sovetzkaya Gavan	Naval base
Vladivostok	Pacific Fleet Headquarters

It's interesting to compare these locations with those reported for past and current SLHFM transmissions.

In March of this year, a monitor in the Netherlands informed me that while he was listening to 3262 kHz, he noted the "P" marker stopped, callsign RMP (shown in callsign listings as Kaliningrad) was sent several times, and then a Baltic area weather forecast was transmitted in CW. I have to believe this supports the notion that the "P" marker transmitter is located at the Baltic Sea Fleet Headquarters in Kaliningrad. The same Dutch monitor provided the following details for active SLHFMs he was currently listening to:

SLHFM	Location	Frequencies (kHz)
C	Moscow	3564, 4302, 5306, 7039, 8459, 10612, 13636, 17016
L	St. Petersburg	3090, 26170
P	Kaliningrad	3167, 3208, 3262, 3264, 3290, 3807, 4043
R	Unknown	3195, 4326, 7452, 25250
S	Arkhangelsk	4301, 8485, 10872, 17015.7
V	Unknown	3658, 4446, 4576

More Mysteries Ahead

Next time we'll investigate another kind of HF marker, one which utilizes four-character callsigns in much the same manner as the SLHFMs (a callup is repeated over and over, then discontinued, short messages transmitted, and the callup then resumed). In the meantime, why not see how many of the SLHFM signals you can hear? Remember, the low frequencies will be heard at night while the higher frequencies are more likely to be heard during the day. ■

Best Bet Shortwave Broadcasts In English

For most people, listening to foreign broadcasts is the biggest lure of shortwave listening. To get you started on the international listening scene, we've provided a listing of some of your "Best Bets." These are stations that you're likely to be able to pick up and that broadcast at least some of the time in English.

How well you receive stations on this list will vary with atmospheric conditions, seasonal changes, your listening location, and receiving equipment. Stations may also make changes in the times and frequencies of broadcasts with little or no advance warning. Not all of the frequencies listed for a particular broadcast will provide equally good reception; some frequencies may not even be in use. Stations may also have other frequencies in use at the times listed here. Many stations are also on the air at other times and on other frequencies. Some broadcasts are on weekdays only or are not on the air daily. Most station schedules are not too long and complex to be included here.

We have provided a general grading to give you some idea of what kind of reception you may expect from each station, based on the use of an average portable receiver under normal propagation conditions. One is poor, two is average, three is good. Listeners in the western part of the U.S. will generally get better reception from Asia and the Pacific than will listeners in the east. Conversely, those in the east will enjoy better reception from stations in Europe and Africa.

Times indicated are UTC (Coordinated Universal Time), a 24-hour universal time system which is five hours ahead of Eastern Standard Time, i.e. 0000 UTC equals 7 p.m. EST, 6 p.m. CST, 5 p.m. MST and 4 p.m. PST. All broadcasts listed are in English, and on average, represent time and frequency combinations which should provide best reception.

Station	Time	Frequencies	Grade
R.Tirana, Albania	0230	6145, 7160	*
R. Algeria	1600	11715, 17745	*
RAE, Argentina	0200	11710	**
R. Australia	1200	9580, 11660, 11800	***
R. Austria	0530	6015	***
R. Vlaanderen, Belgium	2330	13670	*
Radiobras, Brazil	1200	15445	*
R. Bulgaria	2300	9700, 11720	**
R. Canada Int'l	0100	6120, 9755	***
CFRB/CFRX, Canada	24 hrs.	6070	**
China Radio Int'l	0000	9710, 11715	**
AWR, Costa Rica	0000	5030, 6150, 9725, 11870	**
Croatian Radio	0300	5895, 7370, 13830	*
R. Havana Cuba	0100	6010, 9820	***
R. Prague, Czech Rep.	0100	7345	**
HCJB, Ecuador	0030	9745	***
R. Cairo, Egypt	0200	9475	*
BBC, England	24 hrs.	5975, 7325, 9410, 9590, 15220, 15260	***
R. Finland	1230	11900, 15400	**
R. France	1200, 1400, 1600	9805, 11615, 13640	**
Deutsche Welle, Germany	0100, 0300, 0500	5960, 6040, 6145	***
V. of Greece	0130, 0340	6260, 9935, 11635	*

Station	Time	Frequencies	Grade
R. Cultural, Guatemala	0300	3300	*
NBC, Papua New Guinea	1100	4890	**
R. Budapest, Hungary	0330	5965, 7220, 9835	*
All India Radio	1900	11620	*
VOIRI, Iran	0030	7260, 9022	**
Rep. of Iraq Radio (irreg)	1030	13680	*
Kol Israel	0500	7465, 9435	**
RAI, Italy	0050	9645, 11800	**
R. Japan	0300, 1100	5960, 6120	***
R. Jordan	1200	15170, 15270	*
R. Kuwait	1800	11990	**
ELWA, Liberia	0600	4760	*
V of Mediterranean, Malta	0600	9765	*
R. Netherlands	0030	6020, 6165, 9840	***
R. New Zealand	0600	9570	**
V. of Nigeria	0500	7255	*
R. Pyongyang, N. Korea	1100	9977, 11335	*
R. Norway	1200 Sun	15340	**
R. Pakistan	1600	15555, 17660	*
Polish Radio Warsaw	1200	7270, 9525, 11815	*
R. Portugal	0230	9570, 9705, 11840	**
R. Romania	0200	6155, 9510	*
R. Moscow	1200–0700	5915, 7165, 9920, 11675, 13370, 15495	**
R. Singapore	1100	9530	*
Slovak R., Slovakia	0100	5930, 7300, 9440	*
Channel Africa, S. Af.	0300	5955, 9695	*
R. Korea, S. Korea	1030	11715	*
Spanish National R.	0000	9540	**
R. Sweden	0330	6055, 9850	**
Swiss Radio Int'l	0100	5885, 6135, 9885, 9905	**
R. Damascus, Syria	2005	12085, 15095	*
V. of Free China, Taiwan	0200	5950, 9680	***
R. Thailand	0030	9690, 11905	*
V. of Turkey	2300, 0400	9445	**
R. Ukraine	0000	11950	**
UAE Radio, Abu Dhabi	2200	11885, 11970, 13605	**
Voice of America	24 hrs.	5995, 9760, 13710, 15205, 15580	***
R. Tashkent, Uzbekistan	1200	9715, 13785	*
Vatican Radio	0250	6095, 7305	**
R. Nacional, Venezuela	0040	9540	**
Voice of Vietnam	1000	9840, 12020, 15010	*
R. Yugoslavia	0000	9580, 11870	**

DXpeditioning—Remote Radio Listening

So-so reception at home? Just grab a friend, your radio, and hit the road for some great shortwave DX.

By Andrew Yoder

Of the thousands of listeners who regularly tune across the shortwave bands, probably only a few are satisfied with their reception. As the country becomes more urbanized, and the growing population uses more electrical devices, interference abounds—especially for shortwave listeners crammed into apartment buildings or small suburban lots.

If you're seeking out rare and interesting DX (distant stations) on the medium wave and shortwave bands, your quest is doomed if you live in one of these locations. You can move or give up DXing, but neither is an option for me. So, I move temporarily—I take a DXpedition.

A DXpedition is a merger between the words "DX" and "expedition." In amateur radio circles, a DXpedition might mean going to some tiny uninhabitable island and being one of the first operators to transmit from that "country." In shortwave circles, the meaning is much simpler; it's just taking your equipment on an outing and having a radio adventure.

Location, Location, Location

The first consideration is to abide by trespassing laws. Obtain permission from landowners or use state and national parks. Don't overlook land that you don't own but have rights to, such as the back acres of a hunting club you might belong to. I've tried all of these methods. The difference between a good and a bad setup depends more on the geographic location that you choose rather than whether it is private, commercial, or public land.

The next consideration in finding a location that will suit your needs is whether or not the site offers AC power. If the site does not have power, you'll need to operate from a battery system. Unfortunately, some of the table-top DX receivers will only operate with AC input. If you are depending on an AC-only receiver and you're on a site without AC power, you might as well start a fire and practice your smoke-making techniques.

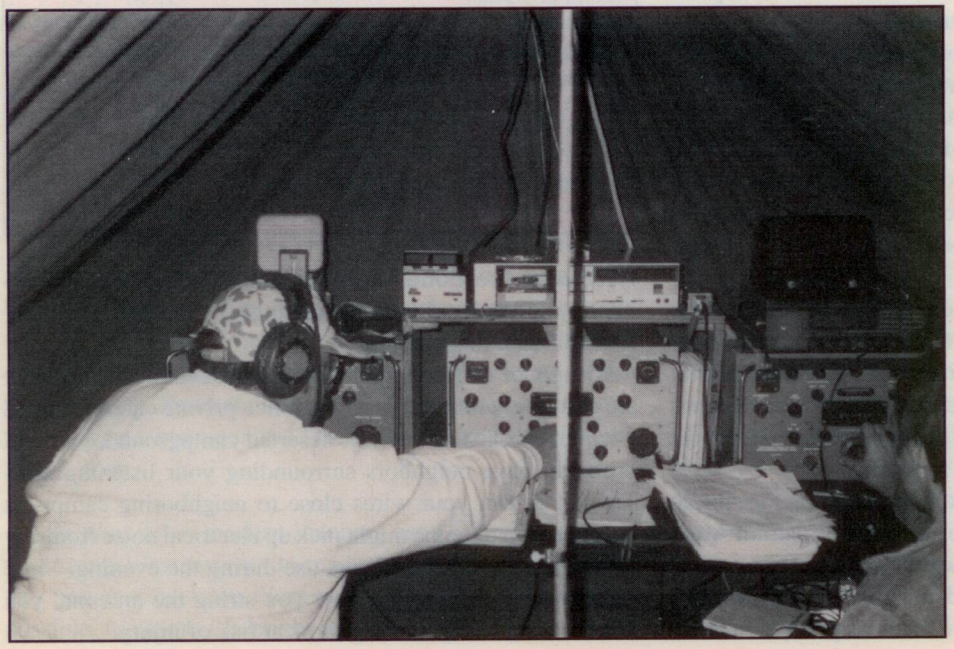
The tent with a makeshift plastic cover. A guyed dipole is running in front of the van and plenty of food is stocked on the table.

Commercial sites include recreational areas and hunt clubs and are primarily private campgrounds. But they are excellent sources of electrical power. There's nothing finer than reaching out from your warm sleeping bag to tune in a rare broadcast, watching the LEDs glow in the chirping darkness

Stringing a longwire through the campground.

of the forest. If you're interested in this option, be sure to call the camp office before you go. Some campgrounds only have 220-volt power outlets and a handful have no power at all. The curse of the commercial campgrounds is the flip side of their blessing: if a number of electrical appliances are being used nearby, your radio might receive as much local electrical noise as rare radio signals.

Don't confuse commercial campgrounds with those in state and national forests. State and national parks are excellent sites because of their extensive acreage, fewer campers (in some situations), and generally lower amounts of electrical interference. Some public parks, however, close at dusk and have no campground provisions. Even if they do, they are more likely to be "primitive" sites without power. Moreover, some park rangers take a rather dim view of radio listening. During a recent DXpedition, the park ranger didn't believe that my friends and I were only planning to listen to the shortwave radio. He even abandoned several dozen fishermen and picnickers to suspiciously keep tabs on us and make sure that we left "his" state park immediately.



DXing inside the tent. Three military receivers and a modern-day receiver, monitor speakers, clocks, a cassette deck, and plenty of notes and radio bulletins are stacked on the table.

To avoid such unpleasantness, it's a good idea to make sure the owners or caretakers of the land you're using are aware of what you're doing. Few people understand what it's all about, so it's best to explain to them what shortwave is, why you would want to listen from that particular location, and why you'll probably need to string long antennas. In most cases, the rangers or managers will be interested in what you're up to and might just drop by to check out your listening post. They might even want to listen, too.

Another concern when DXing at commercial campgrounds is crowding. It is nearly impossible to DX in crowded campgrounds because there is virtually no direction that you can run the antenna wire. Another problem is audible noise. For example, at one beach front campground where we stayed in July, the hundreds of other campers were so loud that it was difficult to sleep until after midnight. Fortunately, these problems usually cure themselves. Because of the bad propagation, the worst shortwave listening season is summer, so few people would go on a DXpedition then. Otherwise, the only time that you might encounter crowded campgrounds would be Labor Day weekend, the first day of hunting in your state, or during a local festival. If you want to be sure that few people are staying in the campground, call the manager in advance.

Don't Forget the Antennas

The antennas you choose are also important aspects of a successful DXpedition. Your choice will depend on what you plan to hear and from what direction the signals will be emanating. The rarest shortwave broadcast stations operate below 6 MHz, so a longwire antenna (or a derivation, such as the Beverage antenna) is one of the best choices. Longwires are also very simple to install, so they're one of my favorites. But *never* connect a long longwire to a portable shortwave receiver—most of these receivers will overload causing images of the stronger stations to appear across the dial. At worst, you could overload the receiver to the point where some components are destroyed.

A longwire antenna is simply one long piece of wire (100 feet or more in length) that's run from your receiver. The major benefit of the longwire (as far as reception is concerned) is that the longer it is, the more directional it is (with the best points of reception being off of the ends of the antenna). For the best directional effect, try to make the wire as many wavelengths long as possible (see table for wavelengths at various frequencies). This is difficult over the medium wave band, where a wavelength is often over 1,000 feet long. If you could manage to make a 1,000-foot long (or longer) longwire, you would notice some rather directional effects when tuning across the medium wave region. Because of these effects, you should try to point longwire antennas at the DX regions you're interested in tuning.

As for the wonders of long, directional antennas, one pirate that we heard was just above the top of the medium wave band. We were listening to it with a great signal on one receiver. But because our tent was crowded, I went outside to check it out on a mere 200-foot longwire that was pointed in nearly the same direction as our main antenna (which was approximately 1,700-feet long). Surprisingly, the signal was barely audible on that antenna.

It might be difficult for you to install several antennas that are extremely long. Unless you rent a private cabin or spend a winter weekend in an icy, deserted campground, you will probably have neighbors surrounding your listening area. Try not to run your wires close to neighboring campsites because your antenna might pick up electrical noise from any appliances the other campers use during the evening. More important, depending on how you string the antenna, you could even place your neighbors at risk of injury.

Antenna Wavelengths

Every radio signal travels through the air as a *wave*. The length of each radio wave is not indiscriminately or haphazardly selected—its length determines its frequency. For example, a local broadcast station on 1600 kHz will always broadcast a radio wave that is approximately 585 feet long. The length of these radio waves is known as the *wavelength*.

In general, transmitting and receiving antennas each work best if they are cut for a specific wavelength or for a multiple of that wavelength. A longwire antenna will receive equally well in the directions that both ends of the wire are pointing. The more wavelengths long the antenna is at a given frequency, the more the antenna's ability to receive is focused in those two directions. So, if you wanted to receive equally well from all directions at your house, you might choose a vertical antenna. But, if you were targeting European AM broadcasters on a DXpedition, you would want to have a *very long* longwire antenna.

The following table includes the full wavelengths for frequencies in the middle of the shortwave broadcast and amateur radio bands. These lengths will give you a pretty good idea of how long your antenna should be for a given frequency range. It's best for a longwire to be at least two or three wavelengths long for optimum performance, though that's not always possible at the lower frequencies.

Band	Frequency	Length in ft. for 1 wavelength
AM broadcast	1600 kHz	585'
160-m amateur	1900 kHz	492'8"
120-m broadcast	2400 kHz	390'
90-m broadcast	3300 kHz	283'6"
80-m amateur	3750 kHz	249'8"
60-m broadcast	4900 kHz	189'
49-m broadcast	6050 kHz	144'8"
40-m amateur	7200 kHz	130'
41-m broadcast	7200 kHz	130'
31-m broadcast	9700 kHz	96'6"
30-m amateur	10100 kHz	92'8"
25-m broadcast	11900 kHz	78'8"
22-m broadcast	13700 kHz	68'4"
20-m amateur	14200 kHz	65'10"
19-m broadcast	15400 kHz	60'10"
16-m broadcast	17700 kHz	52'10"
17-m amateur	18100 kHz	51'8"
15-m broadcast	19000 kHz	49'4"
15-m amateur	21200 kHz	44'2"
13-m broadcast	21300 kHz	43'4"
12-m amateur	24900 kHz	37'8"
11-m broadcast	25900 kHz	36'2"
Citizens Band	27200 kHz	34'4"
10-m amateur	28700 kHz	32'8"

RADIO PIRAÑA INT.

QSL

To: ANDREW YODER ..... We are pleased to confirm your reception report that is in accordance with our programmes details.

Date: Oct 31st. 92 Time: 15:38-15:54 UTC. Freq: 21.460 KHz....

SINPO: 21331 ..... Tx.Power: ....300W.....

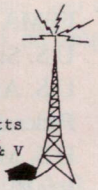
Ant.: Directional 7 dB gain ..... QSL.no: ....105.....

THANK YOU! Sincerely:

P.O BOX 500
RICHLAND, PA 17087

* * EXPERIMENTAL STATION * *

KA2XAU



A. Yoder This will confirm your reception

Transmitter power output 12 (twelve) Watts
Frequency 1620 KHz Antenna Dipole H & V
Modulation A-3 (A.M.) Date 11 01 92

Subject to the provisions of the Communications Act of 1934, subsequent acts, and treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions and requirements set forth in this license, the licensee hereof is hereby authorized to use and operate the radio transmitting facilities hereinafter described for radio communications.

Frequency kHz	Authorized Power (watts)	Emission Designator
540	250 (ERP)	10KA2E
1620	250 (ERP)	10KA2E
9715	250 (ERP)	10KA2E
11705	250 (ERP)	10KA2E
15300	250 (ERP)	10KA2E
17745	250 (ERP)	10KA2E
89.7 MHz	10 (ERP)	75KF3E
100.5 MHz	10 (ERP)	75KF3E

Operation: In accordance with Sec. 5.202(a) of the Commission's Rules.

Mr Yoder,
Thank you for your report. It is appreciated, especially in view of the low power we were operating with during this antenna test. Certainly you are welcome to reprint the above confirmation. Best wishes with your book.

Craig Baker, Owner C.M. Baker Electronics and KA2XAU

Two rare QSLs that were received from the DXpedition that was featured in the photographs.

To limit both the cost and the weight of the antenna, I purchased a 6,000-foot spool of enameled #26 magnet wire. It's surprisingly strong, very light, easily strings through trees, and I can unroll as much or as little as I need for the desired wavelength. I try to keep my antennas strung well above head level so no one is ever at risk of being injured by them, especially because the #26 enameled wire is very difficult to see. The last safety precaution is the most important: never cross any wires while stringing antennas. Don't run your antennas close to power wires. Not only will you probably pick up noise from the power lines, but you could place yourself in a deadly situation.

Gadgets, Gear, and Grub

Aside from your communications receiver and antennas (or wire for longwires), what else do you need? Of course food or a local restaurant is a must. If you bring food, you'll either need it ready-to-eat or you'll have to take along everything necessary to prepare it. I've had everything from excellent homemade chili to far less appealing ready-to-eat junk food on my DXpeditions.

You'll need to have a number of tools available. Things like straight and Phillips screwdrivers, reels of string or Nylon cord, a pocketknife, one or more sets of headphones, solder, and a soldering iron are musts. A cassette deck and blank cassettes for recording stations, many audio hookup cables, a hammer, several extension cords and multi-outlet surge protectors, duct tape and electrical tape, and extra antenna insulators are also necessary.

For comfort, take such things as sleeping bags, pillows, a folding table and chairs, desk lamps, a comfortably large tent, bug spray (for the summer), electric or kerosene heaters (for the winter), and extra weather-appropriate clothing.

As far as DXing supplies go, make sure that you take along a recent copy of the *World-Radio TV Handbook* or the *Passport to World Band Radio*, some radio newsletters (such as *Fine Tuning*, *ODXA*, *NASWA*, etc.), and radio magazines such as *Radio!*, *Popular Communications*, and *Monitoring Times*). If you've made any charts of stations that qualify as your personal DX targets, this is the time to use them.

Laptop computers can also be extremely useful tools on a DXpedition. If you have one, download information from a computer on-line service that covers radio (such as the rec.radio.shortwave newsgroup on the Internet or the general shortwave section on the Fidonet), and be sure to bring this information with you. Laptops are light enough that you can easily drag yours along on a DXpedition. Even if you don't have access to AC power at your location, you can either run the laptop from its built-in battery for a limited time, or you can run the computer off of an external battery supply (my laptop computer requires 12 volts, so it will operate from a standard 12-volt gel cell). You can also operate the computer from your car's battery via a laptop supply or inverter. Unfortunately, a number of computers cause radio interference that will hamper your listening. If this is the case, you will be relegated to either using the computer in your car, using a battery supply away from your receiver location, or using it during listening breaks. Test the computer for interference before you go.

Finally, pull out your handy-dandy radio logbook and take along some ball-point pens. Make sure that you use ball-points and not felt tips—I had a few felt-tip logs that were entirely washed away by rain.

Excursion Results

On one DXpedition in central Pennsylvania, several veteran DXers reported solid loggings of 14 different Peruvian regional stations and dozens of other countries. On a DXpedition on the coast of Washington state, two DXers netted 12 different Indonesian stations with 700-foot and 1800-foot longwires. On another DXpedition at the same location in Washington, the participants logged medium wave stations from New Zealand, Australia, Tonga, and Fiji!

Personally, I usually have much less spectacular results on DXpeditions, in part because I'd rather talk about radio and hear some interesting stories than stay glued to my receiver. On one of my most successful DXpeditions, though, I logged 13 different pirate broadcasters from around the world. Included in these were a Dutch station that ran only 100 watts and a mystery Europirate—I was among the first people in North America to receive QSLs from each of these stations.

The overall success of DXpeditions has been excellent for me and for many other people. It's amazing what enjoyment you can derive from building superior directional antennas in quiet locations while sacrificing personal comfort and hygiene to listen to the radio. Even when the bands are empty, the presence of friends, stories, and experiences of hiking into the middle of nowhere for a weekend of radio listening are well worth the effort. ■

Common Utility Communications Frequencies (in kHz)

2182	International distress/safety
2716	U.S. Navy harbor frequency
3023	U.S. Coast Guard search/rescue
3067	U.S. Air Force
3130	U.S. Navy
3380.5	FEMA
4066.1	Navy MARS
4087.8	Mississippi River barges
4125	Distress/safety
4415	National Guard
5000	WWV time/frequency station
5190	Space launch support units
5197	U.S. Air Force
5264	Spy numbers stations
5277	DEA
5547	Aeronautical
5696	U.S. Coast Guard
5703	Canadian forces
6200	U.S. Coast Guard cutters
6518.8	Inland waterways
6756	U.S. Air Force VIP aircraft
6753	Canadian forces
6792	Spy numbers stations
6927	U.S. Air Force
7527	U.S. Customs Service
7535	U.S. Navy
7651	VOA feeder
7675	NASA
8241.5	U.S. Coast Guard
8241	Distress/safety
8295.5	U.S. Army
8719	Haifa, Israel
8767	Norddeich, Germany
8989	U.S. Air Force
9041	Spy numbers stations
9082	Russian navy
10000	WWV time/frequency station
10242	U.S. Customs Service
10493	FEMA emergency net
10637	U.S. State Department
10780	U.S. Air Force/NASA
10891	Federal Highway Administration
10935	U.S. MAG
11108	Israeli intelligence
11552	U.S. Antarctic stations
12691	Madrid, Spain
13267	National Hurricane Center
13354	National Hurricane Center
13626	FAA
13927	U.S. Air Force MARS
14362	Polish press
14383.5	U.S. Navy MARS
14405	U.S. Air Force MARS
14441.5	U.S. Navy MARS
14510	U.S. Army MARS
14686	DEA
15000	WWV time/frequency station
16463.1	British Navy
16591.5	French Navy
17155	Russian Navy
18205	Civil Air Patrol
18210	Aeronautical
18358.5	Cuban diplomatic
18511	VOA feeder
19440	Radio Moscow feeder
20000	WWV time/frequency station
20053	U.S. Air Force
20480	FAA
20623.5	U.S. Navy MARS
20994	U.S. Army MARS
21811	Spy numbers stations
23675	DEA

So You Want To Get On The Air—But How?

There are so many choices, which one is right for you?

By Tom Kneitel, K2AES

It's great to be a scanner monitoring enthusiast or shortwave listener, and for many folks it satisfies their interest in communications. Others, however, get bitten by the bug that makes them want to be part of the action. They want to get on the air and begin communicating. No doubt about it, communicating is as much fun as it is useful.

There are many different options that invite newcomers to explore communications. So many, in fact, you may find it difficult deciding which is best for your particular interests, needs, and goals.

For instance, do you want to communicate from your home, vehicle, or a handset, with none of the messages related to commercial matters? Do you hope to use the radio for commercial reasons only, or for a combination of commercial and personal purposes? Are you seeking to communicate while hiking or camping, or for safety reasons while on the highway? Do you want to get to know residents of your neighborhood or community? Do you want to obtain an FCC license, and will you need to pass an operator's exam?

These are the major considerations to take into account so you'll end up using the right band and enjoying the fruits of communications "to the max." More than that, you'll be able to select the proper equipment for your needs. Now let's get down to basics.

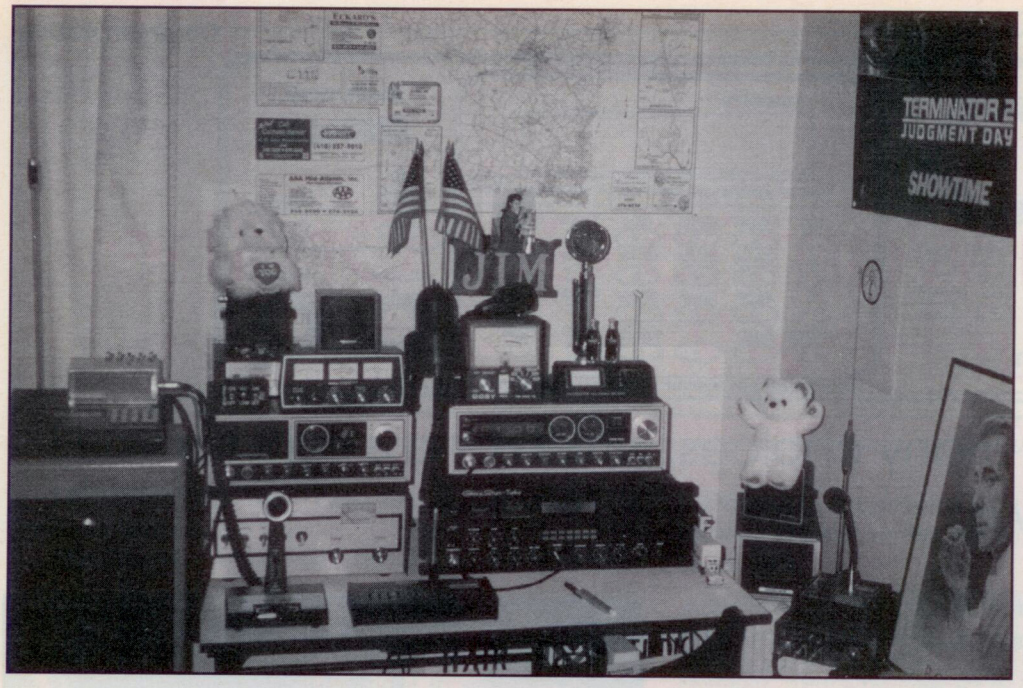
There are communications options to suit all needs. Cellular phones go anywhere, and will meet your most demanding personal or business communication requirements. You can sit in the park and reach out to any telephone in the world.

CB Radio

CB radio has been around since late 1959, but it hit the big time about 1975. That was both a blessing and a curse, for while it made CB a household term, it also turned it into a fad. The CB bonanza went on for a couple of years, fed by a frenzy of media hype, songs, movies, and tens of millions of CB "good buddy" operators.

The image CB earned was of total chaos on the channels. OK, so it *was* a jumble, but hardly ever a cacophony. The boom began to fizzle about 1980, and by 1982 things were relatively back to normal, allowing CB to return to a useful two-way service. But CB emerged from the fad years with a bonus: 17 added channels for a new total of 40. Additionally, equipment had improved, FCC regulations relaxed, and operators no longer needed FCC licenses.

Today, communications permitted over CB include business, personal, hobby, and emergency, in accordance with FCC Regulations Part 95. You aren't permitted to broadcast



From your CB station, you're allowed to chat with radio friends as far as 155 miles away. Here's Jim Yealy's cozy AM and SSB CB base station.

entertainment material, to use the equipment in connection with illegal activities, to advertise or sell goods or services, or to campaign over the airwaves for a political candidate. Nor are you supposed to chat with CBers in other nations or those located more than 155 miles from you.

Stations in the CB service must share the available channels and may channel-hop at will. Channel 9 is officially dedicated to emergencies and traveler's information, though there's no guarantee you'll be able to contact a station to summon help in every area. Channel 19 is used by in-transit mobile operators for traffic and road condition reports, plus driver chit-chat. Channels 32 to 40 are unofficially used only by stations operating in single sideband (SSB) mode. These SSB stations do not normally operate on channels below Channel 32.

Ron Cheshire's on-the-move radio room uses no less than four magnetic mount whip antennas. Held in place safely by magnets, they can be easily removed when not in use.

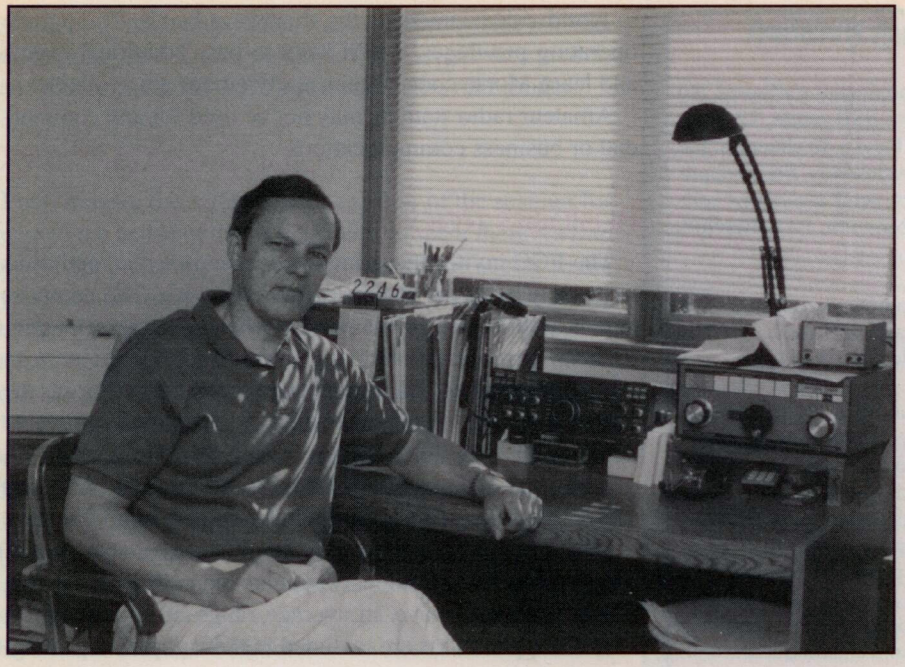
You can limit contacts to your own associated units, but are welcome to make new friends by communicating with random stations.

CB radios operate in the 26.965- to 27.405-MHz band and are permitted by the FCC to use 4 watts in AM mode (12 watts peak envelope power, or PEP, in SSB mode). Equipment is available for handheld, mobile, and base station operation. Base and mobile equipment is available for AM operation alone or to allow switching between AM and SSB modes.

You can expect to hear social and hobby chit-chat on many of the regular CB channels. On Channel 19, you'll hear drivers passing the time with a unique blend of small talk and irreverent humor, intermixed with traffic information.

The SSB channels attract an older group of hobby operators who avoid the usual earmarks of the AM channels, like "handles" and "10-codes." They prefer to follow ham or military communications procedures. SSB stations identify themselves only by means of organization-assigned numbers. For instance, my numbers in the 30-year-old national SSB Network are SSB-13. SSB mode stations are capable of communicating over substantially greater distances than AM mode CB stations.

Keep in mind that CB is *supposed* to be for local communications. Indeed, you should be able to operate from base to mobile around town. At times, however, ionospheric conditions can cause distant (*DX* or *skip*) stations from thousands of miles away to come blasting in so strong they drown out some local stations for an hour or two. That's the nature



Worldwide communications via the low-bands are possible for those who upgrade their entry-level ham licenses. Ted Melinosky, K1BV, compiles a directory of the many awards available to hams who have contacted specific numbers of distant ("DX") stations.

of 27 MHz. Not to worry. You may even find it interesting to occasionally hear the chatter of CBers in other nations.

49 MHz

How about a convenient radio service situated on 49 MHz? It's a fine starting point for someone interested in communicating. This is particularly true for short-range communications used in sports, hiking, camping, biking, fishing, hunting, or other recreational activities. This band is also suitable for short-range communications in offices, schools, warehouses, factories, industrial and construction sites, hotels, stores, health care facilities, and other commercial facilities.

The FCC says you don't need a license to get on the air here, and you're allowed to use the sets for personal, commercial, or virtually any other purpose within their capabilities. While you may occasionally hook up with an unknown unit, chances are you'll predominantly be contacting other radios within your own system. These low-powered sets are permitted to operate with 1/10th of a watt of power and have a communications range of about 1/4 mile. That might not sound like much, but it's farther than the Empire State Building is tall and is a far greater distance than four football fields put end to end. This allows for numerous applications.

Some 49-MHz band radios are handhelds; many are portables for hands-free, voice-activated (VOX) headset operation while the set is clipped to your belt. Radios can be switched to any of the five available channels between 49.83 and 49.89 MHz.

Ham Radio

One wonderful way of getting on the air is through the exciting Amateur Radio service, commonly known as *ham radio*. Over the years, many who cherished the goal of joining the ranks of hamdom ultimately demurred when faced with the FCC's long-standing amateur radio licensing regulations. Some said they couldn't learn Morse code (CW), others couldn't pass the written exam with its heavy emphasis on technical know-how. For some categories of ham licenses, you had to travel to an FCC office to have the exam administered by FCC personnel.

That was *then*, but this is the 1990s! A couple of years ago, the FCC changed everything, making it a snap to get an entry-level license. How about no need to learn Morse code? Or the exam being administered by other hams and given at club meetings? The tests are all multiple choice, and Radio Shack

(Left) Radio Shack's BTX-120 is a 1-watt FM business radio that can communicate over a range of several miles in the 150-MHz VHF band. (Right) GMRS is a rapidly expanding UHF FM personal radio service. This 5-watt Radio Shack PRS-100 handheld transceiver can communicate directly for about seven miles or much further through a GMRS repeater.

Getting On The Air—In A Nutshell

CB Radio: Personal or business communications allowed. No license needed. AM mode, 4 watts max.; SSB mode, 12 watts PEP. Stations may operate on any of the band's 40 channels, but SSB stations normally use nine of them exclusively. For an application for an SSB identification number, send a *stamped* self-addressed long white envelope to: SSB Network, P.O. Box 908, Smithtown, NY 11787.

49-MHz Band: Personal and business communications allowed. No license needed. FM mode, 1/10th watt, with about 1/4 mile range. Units may use all five channels allocated in this band.

Amateur Radio: Personal communications only. Requires at least a Technician class no-code license (issued upon passing a simple multiple choice test) which authorizes voice and packet (computer) communications on ham bands above 30 MHz. Many users participate in FM repeater networks on 144 and 440 MHz. For more information, contact the American Radio Relay League, 225 Main Street, Newington, CT 06111; phone 1-800-326-3942.

Business Radio: Business communications only. Handheld communications on itinerant 150-MHz band channels in the 460-MHz band, offering coverage of several miles. Any person or company engaged in a business activity can apply for an FCC license (no exam required).

GMRS: Personal communications only. License currently required (no exams), and you must be at least 18 years old. License requirement may eventually be dropped. There are seven direct and eight repeater channels in this 462-MHz service. Licensees are limited to one or two channels of their choice, the national travelers' aid channel, as well as all seven direct channels. The 5-watt handhelds have a range of about seven miles. For more information, consider joining the Personal Radio Steering Group, Inc., P.O. Box 2851, Ann Arbor, MI 48106; phone (313) MOBILE-3.

Cellular Phones: Personal and business communications. No license needed for these 800-MHz band radios. You get instant portable or mobile access potential to any telephone or other cellphone in the world. All communications are processed through commercial service providers who charge for their time and efforts.

has study guides containing the questions and answers from which the tests are compiled. Piece of cake.

To obtain a Technician class license now, you need to pass a relatively simple two-part test. You pass if you get 22 out of 30 questions correct in the "Element 2" part, then at least 19 of 25 questions correct in the "Element 3A" section.

Your Technician class license lets you communicate with all other licensees operating on any of the ham bands above 30 MHz. This includes the two extremely active and popular VHF/UHF FM bands, 144 MHz (2 meters) and 440 MHz. Numerous wide-area repeaters on these bands are run by clubs and individuals and permit handheld or other low-powered transceivers to communicate with stations many miles away. Sometimes repeater clubs allow members to place local phone calls from their portable or mobile ham radios. These bands are also used for ham radio packet (computer) communications networks.

Higher grade licenses are also available and open the door to worldwide contacts on the shortwave bands. To upgrade operating privileges, you'll have to pass additional exams and learn Morse code. Again, study guides are available.

Amateur radio stations may not be used for any commercial or business communications.

Business Radio

The FCC invites those involved in commercial activities to participate in the Business Radio Service. The commission is quite liberal in interpreting what a commercial activity is for purposes of obtaining a license for operation on an itinerant frequency. An itinerant frequency license means the unit may be used anywhere in the U.S. To operate, you must apply to the FCC for a license for use on 151.625, 464.50, 464.55, 469.50, or 469.55 MHz. In addition, 154.57 and 154.60 may be used on a more local basis at up to 2 watts.

Most of the sets used for itinerant licenses are handhelds. They've become enormously popular and millions are in use. These handhelds have an average range of several miles. License applications are included in the equipment packaging. An operator test or examination is *not* required for one of these station licenses.

Naturally, the FCC wants the licenses to be used only for commercial purposes. But don't be scared away by the "commercial" requirement. A commercial activity need not be a major full-time corporation in order to qualify an applicant for a license. Perhaps an applicant is engaged in part-time, self-employed work requiring communications. Typical applications include landscaping, janitorial service, fence installation, tours, outdoor recreation, courier service, small boat maintenance, plumbing, electrical work, home improvement, and security.

General Mobile Radio Service

The GMRS is what the FCC once conceived of as a UHF FM version of CB radio. Many years ago, it was even called Class A CB Radio, but the two services went their separate ways. Indeed, they had become so different from one another that the FCC decided to ditch the name Class A CB Radio in favor of General Mobile Radio Service. This is now designated as a personal radio service.

Commercial GMRS stations still exist from the old days when the FCC smiled upon their presence in the band. But the FCC no longer wants commercial users on GMRS channels and only those who are "grandfathered" by having older licenses may remain.

Presently, the FCC requires GMRS stations to obtain licenses. No exams are required, and licenses are granted only to individuals 18 years of age or older. Stations are permitted to transmit via direct or simplex operation (both stations transmit and receive on the same frequency), or may use a wide-area repeater to extend coverage. Many operators of repeaters permit free access to them by other area users. There are seven special simplex frequencies dedicated exclusively to direct communications. These are located in the 462- MHz band. There are eight more 462-MHz frequencies

Cellular has become the communications success story of the 1990s, and no wonder. Still, you'll want to know the whole story before you embark on your cellular career—so read on.

used for repeater outputs. These are also available for simplex (direct) communications.

Unlike CB radio, GMRS stations may not operate on all frequencies. GMRS stations are normally licensed to operate either on only one simplex frequency or only one repeater input/output pair. The license applicant can request, and is usually successful in securing, one additional frequency pair. Furthermore, although the authorization does not specify so on licenses, all GMRS stations may communicate on the national channel set aside for traveler's assistance (462.675 MHz) where many volunteer groups are monitoring. Handheld GMRS transceivers have 5-watt transmitters and offer an average direct signal coverage of up to seven miles, though repeaters extend this range many times over.

GMRS is a rapidly growing hobby and personal radio service, and the FCC is thinking about ending the requirement for individual licenses in this radio service. Good deal!

Cellular Telephones

There are many reasons why you see handhelds and mobile cellphones wherever you go. You can get on the air without any sort of license—pronto. The 800-MHz band handheld and mobile equipment is reasonably priced and simple to operate. You're welcome to gab about business or personal matters and can potentially chat with anyone in the world who has either a regular or a cellular phone. Cellphones also offer a quick and reliable way to summon police, fire, medical, or other help. In short, it's an amazing personal communications technology!

This communications convenience has a few strings attached, though. Cellphone communications must be processed through the facilities of cellular service providers. Local areas have two competing cellular service companies available for subscribers. Their services include allowing subscribers' equipment to send and receive calls via the company's cell sites (short-range repeaters).

There are sundry charges and fees for their services. These might include a basic monthly fee for service, plus costs for each minute of air time, plus toll charges for each call. Many companies expect subscribers to pay for all calls, both outgoing and incoming. Calls to 911 and other essential numbers are usually free. Those who travel beyond the limits of their local company's service area often find they can use their cellphones in distant areas served by other companies. Out-of-area usage is subject to additional "roamer" charges that companies tack on for processing calls to or from transients, tourists, and visitors.

Cellular suppliers offer various packages tailored to suit the calling patterns of subscribers. Check the packages in your area to see which best fits your needs. You'll be expected to sign a service contract for a specific period of time.

What Are You Waiting For?

So don't let me hear you say you can't figure out how to get on the air! We scoured the spectrum from 26 MHz to 800 MHz and look what we found. No less than six easy, effective, and inexpensive entry-level doorways to communicating. Choose your weapons! ■

Talking Back...The World Of Ham Radio

By Richard Moseson, NW2L

If you've been reading through this magazine, chances are you've already read about some exciting things. Things like tuning in news as it happens on your scanner, or listening on shortwave to radio stations from the far reaches of the globe. Ham radio gives you those same opportunities, with one big extra—when you tune in a station from the other side of the world, you can talk back. When there's a major emergency in your town, you can be part of the team that helps provide communications. Ham radio lets you move beyond being a spectator to events. You can be a participant...by talking back.

I got started in ham radio at age 15, a few years after my Scoutmaster introduced me to the fun of talking on the radio with CB. I enjoyed making friends around town on CB and helping people as a member of REACT. But I wanted more. Even so, when a friend introduced me to ham radio, I wasn't sure it was for me. It just seemed too hard. But he managed to persuade me to come a meeting of my high school's newly-formed ham radio club. It didn't have a station yet and only two kids were hams. But we plugged in a shortwave receiver and tossed a piece of wire out the window. The first station we tuned in was Radio Tirana from Albania, then one of the world's most closed societies. I was hooked and became a lifelong shortwave listener. But I also wanted to talk back. Even today, 25 years later, nothing beats the thrill of hearing a faraway ham, calling him—and getting through! Or of sending out a "CQ" ("calling anyone") and having someone answer you from another continent.

Ham radio has done much for me in the past 25 years. And it can do a lot for you, too. Through ham radio, I've been aboard luxury yachts during boat races; I've gotten a police escort through the streets of New York City; and I've watched the New York City Marathon from a catbird seat directly ahead of the lead runners. I've gotten travel directions and suggestions for good places to eat in countless towns around America (hams love to eat). I've gotten several jobs. I've helped provide communications in emergencies. Of course, job offers, emergencies, and boat races don't come along every day, but I enjoy the everyday fun of ham radio as much as all the rest. In fact, the best part of ham radio is that I've

Repeaters give you access to other hams in your community or even at considerable distances. Here's Bill Lyon, KD4LLQ, of Raleigh, NC, enjoying a chat from his car...

To Become a Ham...

You will need to pass an exam to obtain a license from the FCC (U.S.) or DOC (Canada). Most U.S. hams today start out with the no-code Technician class license, which provides operating privileges on all VHF and UHF ham bands. The exam for the Technician license consists of 55 questions about rules and regulations, operating practices, and basic electronics. To operate on the HF (shortwave) bands, you'll need a license class that includes Morse code as part of the exam.

Ham radio license exams are given by trained "Volunteer Examiners," or VEs, at convenient times and locations all over the country. You can get a list of area radio clubs and upcoming exam sessions by calling the American Radio Relay League (ARRL) toll-free at 1-800-32-NEWHAM and requesting a free Prospective Ham Package. License manuals are available at your local Radio Shack store and include some basic introductions to the hobby. For even more information, you can also pick up a copy of *Now You're Talking* (ARRL) or Gordon West's *No-Code Technician Plus* license manuals at your local Radio Shack.

made friends everywhere—with some of the nicest people I've ever met. And anytime I visit a new place, I have new friends just waiting to meet me.

There are so many great ways to enjoy the hobby, too, that we couldn't do justice to them all in one short article. Instead then, let's take a look at one of the more popular aspects for beginners—"repeater operation."

Repeat After Me

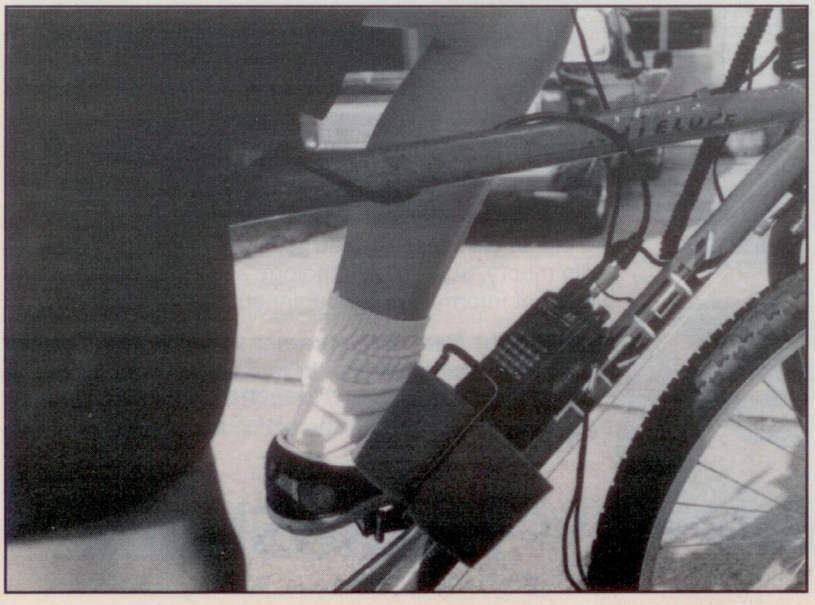
When I started in the hobby, most hams operated on the shortwave bands, what we call HF, for High Frequency. These are the frequencies between 3 and 30 MHz on which you can talk across the country or across the world. And while many, many hams still operate on HF today, the VHF (Very High Frequency) bands have become even more popular. These are the frequencies on which you'll find most mobile and handheld stations operating, often through automatic relay stations called "repeaters." These have become ham radio's local gathering spots. If you're in the car, out walking the dog, or even at home puttering around in your "shack," you flip on the local repeater—just in case one of your friends is there, or someone needs some help you can offer, or in case you run into trouble and need help yourself.

It's on repeaters that you'll find directions when you're lost, suggestions for places to eat when you're in a strange town, or someone to call the police if you come across an accident. Maybe you just want friendly conversation when you're traveling alone and need someone to help keep you awake—that's on the repeaters, too.

How they Work

Repeaters are used on VHF and UHF (Ultra-High Frequency) because radio signals at these frequencies don't travel very well beyond your visible horizon. And if there's something like a mountain between your town and the next, signals won't get through at all. But if you put a station with a sensitive receiver and a fairly strong transmitter on top of that mountain, it'll pick up signals from both sides of the mountain, and you'll be able to hear it on both sides, too. That's just how repeaters work. Everyone (except the repeater) transmits on one frequency and listens on another. (The difference between the transmit and receive frequencies is called the "offset" or "split." On the 2-meter band, the standard "split" is 600 kHz.) The repeater operates on the opposite frequencies, listening on everyone else's transmit frequency and then automatically retransmitting everything it hears on everyone else's receive frequency. This gives your handheld or mobile station a signal as strong as it would have if YOU were up on top of that mountain—with a sensitive receiver, a powerful transmitter, and a big antenna! It also extends the range of your signals from "line of sight" to several dozen miles on all sides of the repeater.

There are also repeaters that are linked together into networks that give you a communication range of several hundred miles, even up to 1,000 miles. Four of the biggest networks are the Zia Connection in Arizona and southern



...but you don't even need a car to take advantage of a local repeater, as Kevin Littlewood, KC4THW, aptly demonstrates.

California, the Condor Connection in California and Nevada, the Evergreen Intertie in the Pacific Northwest, and the Piedmont Coastal Radio Network in North Carolina and Virginia.

There are even some repeaters linked to HF frequencies that offer international coverage. I remember driving through central Pennsylvania one day, using my 2-meter handheld with a 25-watt amplifier and a rooftop antenna. The local repeater was linked to HF...and I spent about a half hour chatting with two hams in Germany!

High-Flying Repeaters

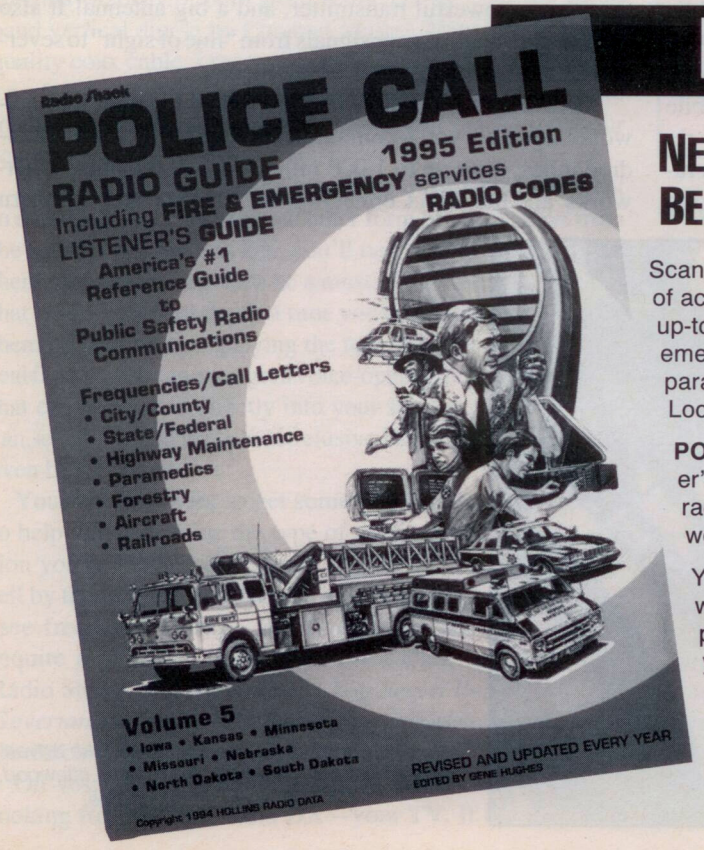
Now, if a repeater on a mountaintop can extend your range from a few miles to a few dozen, imagine what your range would be through a repeater in space! You could cover half the world! You could, and you can, with amateur satellites. These "OSCARs" (for Orbiting Satellite Carrying Amateur Radio) are really repeaters in space, and you need fancier gear and bigger antennas to use most of them. But there's one in orbit right now—OSCAR 27—which, in theory, can be accessed with a handheld (actually, you'll need two handhelds, or a dual-bander).

Like all ham radio satellites, OSCAR 27 operates on two different ham bands. In this case, the "uplink" (your frequency for transmitting *up* to the satellite) is on the 2-meter band, and the "downlink" (on which the satellite transmits *down* to you) is on the 70-cm band. The only hitch here is that it transmits on 435 MHz, so you'll need a rig like Radio Shack's HTX-404, which can be programmed to operate on 430–440 MHz as well as 440–450 (where most repeaters are). I once used an HTX-404 as an uplink to try to make a contact through one of OSCAR 27's predecessors, OSCAR 21, which had its uplink on 435 and its downlink on 145 MHz (OSCAR-21 has since gone off the air). A new satellite planned for launch in 1996 is supposed to be even easier to contact using basic equipment.

Another satellite you can contact using an FM radio (most of them use single sideband and Morse code) is one with people aboard—the Russian MIR space station. And the Russians have had a ham station active on MIR for several years. There's a packet radio (computer-to-computer) bulletin board that's almost always accessible, and, when the crew members have free time, they often pick up the mic and chat with anyone who happens to be listening back on Earth. All MIR contacts are on the 2-meter band (their primary frequency is 145.55 MHz, which you can tune in on a scanner or 2-meter ham rig).

Why Not Be Part of the Action?

Radio hobbies, in all of their many forms, can be great fun. If you want to tune in stations from around the world, shortwave listening is just right for you. If you want to listen in on the action around your home town, a scanner is what you need. But if you want to be part of the action, if you want to *communicate* with stations from around the world, and you want to do it badly enough to study and pass a licensing exam, then join the fast-growing world of ham radio and *talk back*! ■



INSIDE INFO

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In Review: Communications Headset With VOX

By Harold Ort, N2RLL

Every now and then a product comes along that everyone needs—well, at least most communications enthusiasts need. The new Radio Shack Communications Headset with VOX (#19-312) is such a product.

VOX (voice-operated) headsets are really nothing new: they've been around for years. "Technical-ese" aside, they're simply a headset, often with a single earpiece, with a flexible microphone and an automatic electronic switching circuit that allows hands-free use of a transceiver. The plugs connect to the mic and earphone jacks of the ham or CB rig, usually a walkie-talkie. Then you simply turn on your rig and speak clearly. The radio transmits as you speak. Stop talking, and the radio stops transmitting.

Basic Features

Designed primarily for the HTX-202/404 Radio Shack amateur handhelds, the professional-looking headset also works with Radio Shack business band, GMRS, and CB transceivers that have external mic/speaker jacks. Incidentally, it's also compatible with Icom, Standard, Alinco, and Yaesu transceivers.

Again, as I always emphasize, read the instruction manual. Even using a piece of equipment as straight-forward as this communications headset is a lot easier when you know *all* about its unique features. Besides, many "defective" returns can be traced to users not being thoroughly familiar with the product.

This headset has several features I found particularly useful. First, it's truly lightweight—you hardly know it's there. All too often VOX headsets are cumbersome and weighty, like you're wearing a pair of sneakers on your ears. Here's a headset that fits snugly and even has a smooth plastic piece at the very top. That's good news for those of us who still have some hair on top of our heads and want to keep it there—not get it caught in the metal strips found on some headsets!

The VOX microphone and headset is fully adjustable and can be flexed to be positioned 1/2 to 1 inch from your mouth. Midway down the 5-foot-long cord is the small controller box that also holds the single AAA battery that powers the headset. Controls include a simple push-to-talk (PTT) button and a circular switch for OFF/PTT, and either high or low VOX sensitivity. The back of the 2-inch by 1 1/2-inch box also has a sturdy clip for securing it to your pocket.

Checking It Out

The Communications Headset is ideal for using your HT while you're out walking, hiking, biking, or in any other situation where manually using the mic button is inconvenient or simply impossible.

The Radio Shack Communications Headset with VOX is convenient, lightweight, and fully adjustable.

As the instructions point out, when using the VOX feature, the headset will quickly switch to transmit when you start talking. However, "some transceivers require more time between when the transmit circuit is activated and when it actually begins to transmit...the first part of the word you say might not transmit. You might want to precede your transmission with 'Ummm,' or extend the first sound to ensure your entire message is received." While this is true with this and other VOX headsets I've used, it isn't a big problem. After all, as is often the case, there's a trade-off: you're looking at the convenience of hands-free communication versus a minor inconvenience of preceding your transmission with "Ummm," or other such word.

First, I checked the VOX headset using the PTT button. Regular hams I communicate with daily noticed no difference in my audio. To me, that's good news. Typically, if

Q Signals

Given below are a number of Q signals whose meanings most often need to be expressed with brevity and clarity in amateur work. (Q abbreviations take the form of questions only when each is sent followed by a question mark.)

QRG	Will you tell me my exact frequency (or that of ____)? Your exact frequency (or that of ____) is ____ kHz.
QRH	Does my frequency vary? Your frequency varies.
QRI	How is the tone of my transmission? The tone of your transmission is ____ (1. Good; 2. Variable; 3. Bad).
QRJ	Are you receiving me badly? I cannot receive you. Your signals are too weak.
QRK	What is the intelligibility of my signals (or those of ____)? the intelligibility of your signals (or those of ____) is ____ (1. Bad; 2. Poor; 3. Fair; 4. Good; 5. Excellent).
QRL	Are you busy? I am busy (or I am busy with ____). Please do not interfere.
QRM	Is my transmission being interfered with? Your transmission is being interfered with ____ (1. Nil; 2. Slightly; 3. Moderately; 4. Severely; 5. Extremely.)
QRN	Are you troubled by static? I am trouble by static ____ (1–5 as under QRM).
QRO	Shall I increase power? Increase power.
QRP	Shall I decrease power? Decrease power.
QRQ	Shall I send faster? Send faster (____ WPM).
QRS	Shall I send more slowly? Send more slowly (____ WPM).
QRT	Shall I stop sending? Stop sending.
QRU	Have you anything for me? I have nothing for you.
QRV	Are you ready? I am ready.
QRW	Shall I inform ____ that you are calling on ____ kHz? Please inform ____ that I am calling on ____ kHz.
QRX	When will you call me again? I will call you again at ____ hours (on ____ kHz).
QRY	What is my turn? Your turn is numbered ____.
QRZ	Who is calling me? You are being called by ____ (on ____ kHz).
QSA	What is the strength of my signals (or those of ____)? The strength of your signals (or those of ____) is ____ (1. Scarcely perceptible; 2. Weak; 3. Fairly good; 4. Good; 5. Very good).
QSB	Are my signals fading? Your signals are fading.
QSD	Is my keying defective? Your keying is defective.
QSG	Shall I send ____ messages at a time? Send ____ messages at a time.
QSK	Can you hear me between your signals and if so can I break in on your transmission? I can hear you between my signals; break in on my transmission.
QSL	Can you acknowledge receipt? I am acknowledging receipt.
QSM	Shall I repeat the last message which I sent you, or some previous message? Repeat the last message which you sent me (or message[s] number[s] ____).
QSN	Did you hear me (or ____) on ____ kHz? I did hear you (or ____) on ____ kHz.
QSO	Can you communicate with ____ direct or by relay? I can communicate with ____ direct (or by relay through ____).
QSP	Will you relay to ____? I will relay to ____.
QST	General call preceding a message addressed to all amateurs and ARRL members. This is in effect "CQ ARRL."
QSU	Shall I send or reply on this frequency (or on ____ kHz)? Send a series of Vs on this frequency (or ____ kHz).
QSW	Will you send on this frequency (or on ____ kHz)? I am going to send on this frequency (or on ____ kHz).
QSX	Will you listen to ____ on ____ kHz? I am listening to ____ on ____ kHz.
QSY	Shall I change to transmission on another frequency? Change to transmission on another frequency (or on ____ kHz).
QSZ	Shall I send each word or group more than once? Send each word or group twice (or ____ times).
QTA	Shall I cancel message number ____? Cancel message number ____.
QTB	Do you agree with my counting of words? I do not agree with your counting of words. I will repeat the first letter or digit of each word or group.
QTC	How many messages have you to send? I have ____ messages for you (or for ____).
QTH	What is your location? My location is ____.
QTR	What is the correct time? The time is ____.

there was a difference in audio, they'd tell me. The receive audio in the single earpiece was very good—just the right tone, too. Of course, the receive audio volume is controlled by your rig's volume control.

Then, switching to the VOX function (high sensitivity setting), I called Harry, W2IX, on simplex. No "Ummm's" to initiate the VOX, just a straight call to Harry. He said the audio was "crisp and very clear." Harry, who has been a ham longer than I can remember, correctly pointed out to me that using a VOX headset is "tricky business." That is, the proper combination of the position of the boom mic and VOX sensitivity setting are the key ingredients in getting the most out of any VOX unit. Just the right speaking volume is also essential. It's something you get used to; even your rate of conversation is something you have to keep in mind. Speak too slowly with frequent pauses, and the transmitter shuts down; speak too quickly and you might sound like you're on a coffee diet!

The "low" VOX sensitivity setting requires you to speak more loudly or have the mic closer to your mouth. This is not unusual. The "high" sensitivity setting is really for low noise situations, such as when you're certain no one in a nearby room, or other sources of extraneous noises, can trigger your transmitter.

You can expect the AAA alkaline battery (not included) to last a long time. I used the VOX Headset for a couple of hours nearly every day for a couple of months, and the battery was still going strong. The specifications say you'll get about 500 hours of VOX operation. Quite reasonable, indeed!

Watch How You Position the Connection Cord

Remember the importance of reading the instruction manual? On page 6 you'll see a simple "caution" notice warning you to keep the connection cord and controller away from the transceiver's antenna. If you don't, you might think either your transceiver or VOX unit is defective! Probably not true. The simple interaction between the VOX unit and the transceiver might actually shorten your range or cause the VOX to incorrectly switch between transmit and receive. Transmitting using the VOX function and allowing the connection cord to fall near my HTX-202 transceiver caused the HT to transmit uncontrollably every second or two until I moved the cord away from the HT. Again, this is a common occurrence—you simply have to remember to keep the cord and controller as far from your transceiver as possible.

Overall, the Communications Headset with VOX is a good investment ($49.99). It's there when you need it and easy to use. And, there will be those times when operating hands-free is more than a convenience, it may be a necessity.

Enterprising hams may find a way to improvise some sort of wind cover for the mic to keep their HTs from transmitting because of wind noise when biking or jogging. Now, only if I could fit my bike helmet over the headset.... ■

Using Your Cellular Phone In An Emergency

You can stay safe and help others on the highways. Here's how.

By Chuck Gysi, N2DUP

Many cellular phone users may have initially bought a mobile phone for business reasons or to be able to keep in contact with family members while on the highway. But for many people these days, the safety aspect is the primary reason for having a mobile phone.

In fact, a survey by Public Opinion Strategies of Alexandria, Virginia, found that 62 percent of cellular users polled cited safety and security as the main reason for purchasing a cellular phone. That number is almost twice the number who said they got a cellular phone for business convenience. In addition, half of all those surveyed said they had used their car phone to report car trouble, medical emergencies, crimes, or drunk drivers.

Indeed, the Cellular Telecommunications Industry Association reports that, according to the most recent figures tabulated, about 550,000 calls a month are made by cellular users to 911 and other emergency numbers.

According to a recent poll, as many as 62 percent of cellular purchases are made because their users feel safer and more secure on the highway. Here a motorist puts her cellular phone to use in making an emergency call.

The "Star" Numbers and 911

So what happens when you dial 911 or other emergency numbers from your cellular phone? Who are you connected with? How do you report an emergency?

In many states and regions, there are so-called "star numbers" that allow a cellular phone user to reach a specific service with a minimal effort of dialing. For instance, if you're driving on the Pennsylvania Turnpike and need emergency assistance, you dial *11 (star-one-one) from your cellular phone. This call connects you directly with the turnpike's communications center near Harrisburg, Pennsylvania, which has communications capability with all emergency services along the state's turnpike.

Likewise, in Iowa, by dialing *55 in most areas, the caller will be connected with the closest Iowa State Patrol post for highway assistance.

Many areas do have the familiar 911 emergency service in the vicinity of the cellular tower. If so, your call will go to the closest public safety answering point, or PSAP. This typically will be a county dispatch center, a city's police department, or other similar agency that handles the 911 calls in the area of the cellular tower. But not all areas, especially rural ones, offer 911 emergency service, and dialing 911 may connect you with an operator instead of the local emergency dispatcher.

Some Tips to Remember

The thing to remember in making a 911 call from your car is that you may not be connected with the dispatcher who needs to handle your call. For instance, if you are in western Indiana and you dial 911, your call may be picked up by a

Emergency Star Cellular Numbers

In addition to the 911 emergency number, "star" numbers can be used to access emergency services in many areas of the U.S., Canada, and other countries. Here's a list of emergency star numbers and other speed-dial numbers for various areas. In some areas, the star number will work for both the "A" (non-wireline) and "B" (wireline) carrier. Your cellular service provider can tell you whether you're on an "A" system or "B" system. Your handset may also indicate that information.

Statewide Speed-dial Numbers

Arizona—*33, Arizona Highway Patrol (most systems).
New Jersey and Delaware coasts—*24 (*CG) for Coast Guard (most systems).
South Carolina—*47 (or *HP) for highway patrol (most systems).
Hawaii—*8724 (*USCG) for Coast Guard (B systems).
Iowa—*55 for Iowa State Patrol (most systems).
Kansas—*47 (*HP) for highway patrol, *582 (*KTA) for Kansas Turnpike Authority (most systems).
Gulf of Mexico (Louisiana, Mississippi, Texas coasts)—911 for Coast Guard (A and B systems); *24 (*CG) for Coast Guard search and rescue (A system).
Maine—*77 (*SP) for Maine State Police, *24 (*CG) for Coast Guard (B systems).
Massachusetts—*77 (*SP) for Massachusetts State Police (A and B systems).
Mississippi—*47 (*HP) for highway patrol (most systems).
Missouri—*55 for highway patrol (most systems).
Nebraska—*55 for state patrol (B systems).
New Hampshire—*77 (*SP) for state police (A system).
North Carolina—*47 (*HP) for highway patrol (most systems).
Ohio—*4357 (*HELP) for Ohio Highway Patrol (A systems).
Oklahoma—*55 for highway patrol (most systems).
Pennsylvania—*11 for Pennsylvania Turnpike emergencies (most systems).

City or Regional Speed-dial Numbers:

Denver, CO—*384 (or *DUI) to report a drunk driver (B system).
Springfield, MA and Pittsfield, MA—*677 (or *MSP) for Massachusetts State Police (A system).
Bridgeport, CT, and Torrington, CT—*999 for poison control, *8724 (or *USCG) for Coast Guard (B system).
Miami, FL—*25378 (*ALERT) to report dumping, graffiti or vandalism (B system).
Ocala, FL—*47 (*HP) for Florida Highway Patrol (B system).
Albany, GA—*99 for police (A system).
Phenix City, AL—*99 for police (A and B systems).
Valdosta, GA—*47 (*HP) for highway patrol, *57 (*LS) for Lowndes County sheriff, *87 (*VP) for Valdosta police (A system).
Boise, ID—*477 (*ISP) for Idaho State Police (A system).
Chicago area—0 (zero) or *999 for emergencies (A and B systems); *384 (*DUI) to report drunk drivers (A system).

Using a cellular phone in an emergency is as easy as 1-2-3.

cellular tower in Danville, Illinois—instead of by an Indiana public safety agency. Your call is going to the dispatcher *closest to the cellular tower* processing your call.

To be on the safe side, you need to state immediately that you are calling from a cellular phone and that you wish to report an emergency. By stating your location and the type of emergency right from the start, the dispatcher can determine whether he or she will handle the call for you or transfer it to another agency. If the call is transferred, stay on the phone and wait for the other agency to answer. In a severe emergency, the dispatcher may take all the information anyway and relay it to the appropriate agency either via telephone or point-to-point radio systems.

Basically, if the dispatcher knows where you are and what services you require, it makes his or her job easier. If, on the other hand, the dispatcher has to figure out that you're calling on a car phone from outside his service area, it only compounds the dispatcher's efforts.

Pontiac, IL—0 (zero) or *999 for emergencies, *384 (*DUI) to report drunk drivers (A system).
Frederick, MD—*373 (*FPD) for Frederick police, *33 (*DD) to report drunk drivers (A system).
Saginaw, MI—*27 (*CS) for crimestoppers (B system).
St. Louis, MO and Cape Girardeau, Mo.—*311 for Missouri police, *511 for Illinois police (A system); 311 for St. Louis County emergency, 511 for Illinois emergency (B system).
Nevada, MO—311 for emergency (B system).
Sedalia, MO—*311 for police (A system).
Omaha, NE—#333 to report an accident (A system).
Las Vegas, NV—*384 (*DUI) to report drunk drivers (B system).
Portsmouth, NH—*63 (*ME) for Maine police, *64 (*NH) for New Hampshire police (B system).
Albany, NY, Buffalo, NY, and Auburn, NY—*394 (*DWI) to report drunk drivers (A system).
Kingston, NY, Newburgh, NY, New York City and Northern New Jersey, Syracuse, NY, and Poughkeepsie, NY—*394 (*DWI) to report drunk drivers (B systems).
Jamestown, NY, and Watertown, NY—*394 (*DWI) to report drunk drivers (A and B systems).
Rochester, NY—*767 (*SOS) for Coast Guard, *394 (*DWI) to report a drunk driver (B system).
Fayetteville, NC—*529 (*LAW) for local police, *67 (*MP) for military police (A system).
Youngstown, OH—*11 for Gold Cross Ambulance (A system).
Bedford, PA—*33 (*DD) to report drunk drivers -A system).
Chambersburg, PA—*12 for Interstate 81 assistance, *33 (*DD) to report drunk drivers) (A system); *394 (*DWI) to report drunk drivers, *12 for Pennsylvania State Police (B system).
Harrisburg, PA—*394 (*DWI) to report drunk drivers, *12 for Pennsylvania State Police (B system).
Providence, RI—*677 for state police (A system).
Charleston, SC—*24 (*CG) for Coast Guard (B system).
Florence, SC—*267 (*COP) for police (A system).
Myrtle Beach, SC—*24 (*CG) for Coast Guard (A system).
Corpus Christi, TX—*2273 (*CCPD) for Corpus Christi police (A system).
Graham, TX, and Vernon, TX—*54 for state police (A system).
Laredo, TX—4357 (HELP) for police (B system).
Salt Lake City, UT—*5731 to report drunk drivers (B system).
Danville, VA—*77 (*SP) for Virginia State Police (A system).
Harrisonburg, VA, and Norton, Va.—*47 (*HP) for highway patrol (A system).
Longview, WA, and Seattle, WA—211 for Washington State Patrol (A system).
Seattle, WA—*24 (*CG) for Coast Guard (A system).
Spokane, WA—*477 (*ISP) for Idaho highway patrol (A system).
Wenatchee, WA—*211 for state patrol (B system).

Canada Speed-dial Numbers:
St. John, New Brunswick—*16 for Coast Guard alert (B system).
Thunder Bay, Ontario—*16 for Coast Guard, *677 (*OPP) for Ontario Provincial Police (B system).
Toronto, Ontario—*677 (*OPP) for Ontario Provincial Police (B system).
Charlottetown, Prince Edward Island—*7267 (*RCMP) for emergency (A system); 0 (zero) for emergency (B system).

Foreign Speed-dial Numbers for Travelers
Bahamas—919 for emergency (B system).
Bermuda—911 for emergency (B system).
Cayman Islands—911 for emergency, 500 for fire, 999 for police, 555 for hospital (B system).
Dominican Republic—711 for emergency (B system).
Grenada—911 for emergency (A system).
Guadeloupe—911 for emergency (B system).
Guam—911 for emergency (most systems).
Hong Kong—999 for emergency (A system).
Jamaica—199 for emergency (B system).
Martinique—911 for emergency (B system).
Mexico—115 for fire, 112 for police (most B systems).
Montserrat—911 for emergency (A system).
Puerto Rico—911 for emergency (most systems).
St. Maarten—2211 for ambulance, 911 for Dutch police (B system).
St. Martin—911 for French police (A system).
Singapore—999 for emergency (B system).
U.S. Virgin Islands—922 for ambulance, 999 for Coast Guard, 911 for emergency, 915 for Virgin Islands police (A system); 0 (zero) for emergency (B system).
British Virgin Islands—911 for emergency (A system).

U.S. and Canada Cities (where caller needs to dial *911, precede 911 with a star for emergency
Forest City, AR (A); Grand Rapids, MI (B); Kalamazoo, MI (B); Mount Pleasant, MI (A&B); Saginaw, MI (B); most Minnesota cities (B); Jackson, MI (B); Meridan, MI (B); Philadelphia, PA (A); Watertown, SD (B); Monroe, WI (B); Milwaukee, WI (B); Vancouver, British Columbia (B).

NOTES
The state police or highway patrol in many states can be reached by dialing the universal toll-free number of (800) 525-5555. While the call may be free of tolls, there may be an airtime charge to access this number.

Also, be sure to pay attention to signs when you are entering a state or city for star or speed-dial cellular emergency numbers that may be posted—your life may depend on it!

After stating that you're calling from a cellular phone, giving your location, and the nature of the emergency, provide the dispatcher with any additional information needed to dispatch the proper agencies. If there's an accident, for instance, tell the dispatcher how many people seem to be injured (so they can send more than one ambulance if necessary), whether anyone is trapped (so a rescue squad can be alerted), whether there's a fire (so the fire department can be sent), and whether the highway is blocked (so additional officers or troopers can be sent to handle traffic flow). By calling on your cellular phone, you may be the first set of eyes and ears on an emergency scene, and the dispatcher will depend on you for the appropriate response by emergency services.

Let's say you spot a house fire. You'll want to make sure you have the address. You should also describe the home (two-story, ranch, color, etc.), advise whether you think everyone has escaped (is the family gathered on the front lawn?), whether the house appears to be abandoned, etc.

Again, the more information the dispatcher has initially, the better the response will be by the appropriate units.

Perhaps you're following a possible drunk driver; first be sure to tell the dispatcher the license plate number of the car, then describe the vehicle and other details. What direction are you traveling and on what road? What crossroad have you passed recently and what crossroad are you approaching? Describe the drunk driver's actions. Is he or she weaving from one side of the highway to the other? Is the center line being crossed? Has the car struck anything alongside the road? As long as the dispatcher knows where you are headed, he should be able to send an officer to help intercept the drunk driver.

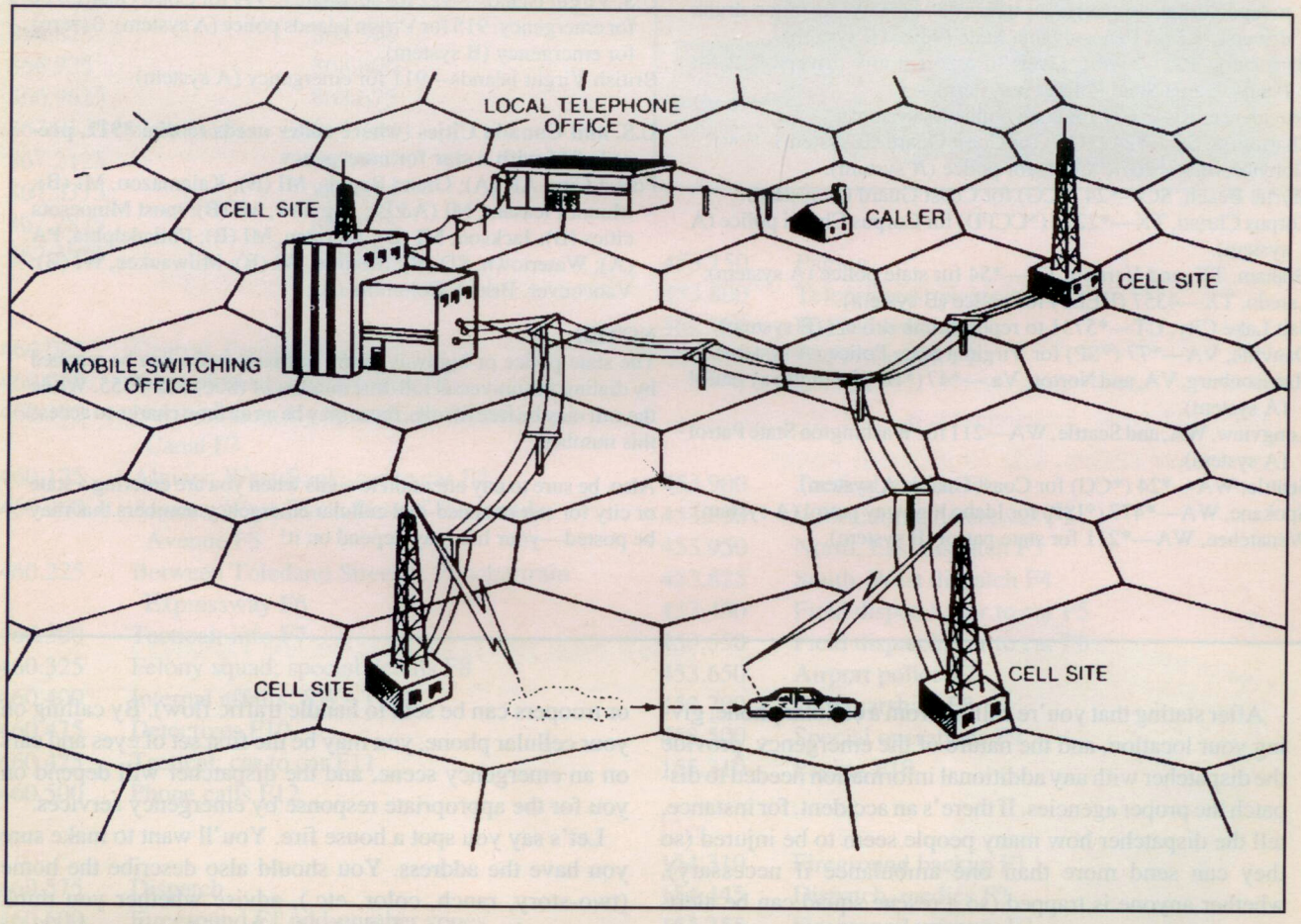
But Look Out for Yourself, Too

Being a cellular Samaritan requires one other thing: Be an observer...but stay out of harm's way. If you're reporting a house fire, don't try to be a hero. If you're reporting a vehicle accident, don't add to the confusion at an accident scene by stopping right at the crash site. Pull over into a parking lot or off the roadway and out of the path of other moving traffic before calling 911. Likewise, don't follow a drunken driver too closely because he might make unpredictable moves, like braking suddenly causing you to crash into his car. Like town watch participants, you are only to observe and report and not take any action.

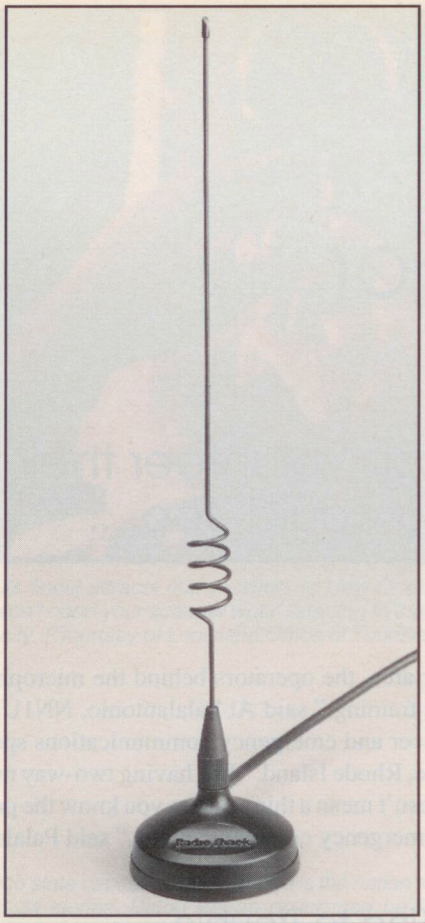
Also be aware that, while 911 may be a free call from your local cellular service area, it may not always be the case in other areas. So, if you travel to other areas frequently, you may want to check with the cellular carrier that serves that location to ensure that 911 calls are free if you're a "roamer" in their system. Certainly, you want to help out in reporting an emergency, but you don't want to be shocked when you get your phone bill showing roamer and access fees for placing 911 calls. Luckily, most cellular carriers do offer 911 as a free call.

Growing Recognition, Growing Impact

More than half a million emergency calls are placed by cellular phone users every month, and the number is bound to increase. Today, there are more than 16 million cellular phones on line in the U.S., and almost 13,000 new phones come on line every day. So many more eyes and ears on the highways with the ability to communicate will obviously impact the number of emergency calls dispatchers will receive from cellular phones.



As this diagram indicates, the cellular tower nearest the cellular user picks up an emergency call and relays it to the nearest public safety dispatch center. Remember, the call may not be picked up by the emergency agency in your area.



If you want to depend on your cellular phone in an emergency, make sure you've got a good antenna. In rural and fringe coverage areas, a good outside antenna on your vehicle is essential.

The cellular industry recognizes those who use their phones to help promote safety, tracking customers who've assisted in emergencies. Those names are submitted to the Cellular Telecommunications Industry Association, which each year honors five cellular users for saving lives and promoting safety via cellular phones. These VITA (Latin for "life") awards are presented in five categories: highway safety, crimestopper, lifesaver, cellular Samaritan, and the grand VITA award. Winners receive a commemorative plaque and a $1,000 donation made to the charity of their choice.

A recent Motorola Cellular Impact survey by the Gallup Organization showed that nine out of 10 survey participants say their cellular phones make them feel safer and more secure. In addition, 90 percent say they are more willing to lend a helping hand to a stranger if they have a cellular phone. "The cellular phone is a unique crime-fighting tool," says Dewey Stokes, national president of the Fraternal Order of Police. "It provides cellular customers with an anonymous and safe method of getting involved. And with 16 million extra sets of eyes, it helps law enforcement fight crime and is a major effort in community policing with other cellular crimestopper programs."

In this day and age, that's something to phone home about.

Hams: Taking your 2-meter HT on the road? Here's

More Power "2" You!

Now you can boost your signal and enjoy crisp, clear reception when operating your 2-meter handheld transceiver from a vehicle.

Radio Shack's new 2-meter power amplifier is designed specifically for mobile use. Its superbly engineered front end teams a helical receive filter that dramatically reduces intermod distortion with a compensating preamp that maintains received-signal strength. It's ideal for RF-crowded urban areas where multiple out-of-band signals can create annoying interference.

This $1\frac{3}{8} \times 3\frac{15}{16} \times 6\frac{1}{8}$" powerhouse accepts 0.5 to 5 watts input and outputs a full 30 watts—plenty of power to carry you to distant repeaters. Team it with the RadioShack HTX-202 transceiver and $\frac{5}{8}$-wave magnetic-mount antenna, and you've got a mobile rig that's hard to beat!

Get the most from your HT today with the 2-meter power amplifier, just $119.99.

For 2-meter VHF (144-148 MHz) band, FM only. Requires 13.8VDC.

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Two-Way Radios For Public Service

Many thousands of radio enthusiasts volunteer their time for the good of others. Maybe you could, too....

By Gordon West, WB6NOA

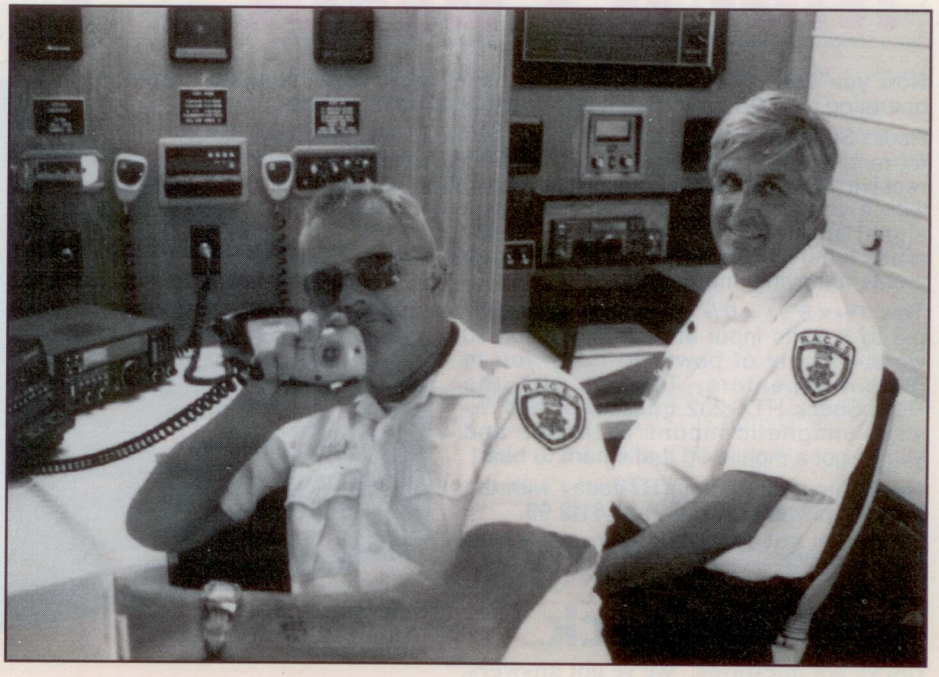
When disasters strike or emergency conditions knock out telephones and power lines, portable two-way radios and mobile radios on portable power packs take center stage for their life-saving and public service capabilities.

"Two-way radio was the only way we could all stay in touch," comments Red Cross communications specialist Cindy Hughes, KC6OPI. "When the rivers in the Southeast overflowed their banks, cellular, power, and telephones were knocked out—only mobile and portable radios were able to stay on the air," adds Hughes, who is a licensed amateur operator and works closely with all forms of two-way radio services in disaster areas.

"But for two-way radios to be of value in an emergency or disaster area, the operators behind the microphone need the proper training," said Al Palalantonio, NN1U, a retired police officer and emergency communications specialist in Providence, Rhode Island. "Just having two-way radio capabilities doesn't mean a thing unless you know the proper protocol for emergency communications," said Palalantonio.

REACTing to Trouble

There are many ways that you can acquire emergency radio training. Some emergency communications programs are sponsored by disaster programs funded specifically for citizens to "hold their own" over inexpensive non-licensed two-way radios a day or two after disaster strikes. There are also



RACES members in the ham radio mobile command post. (Photo by Gordon West.)

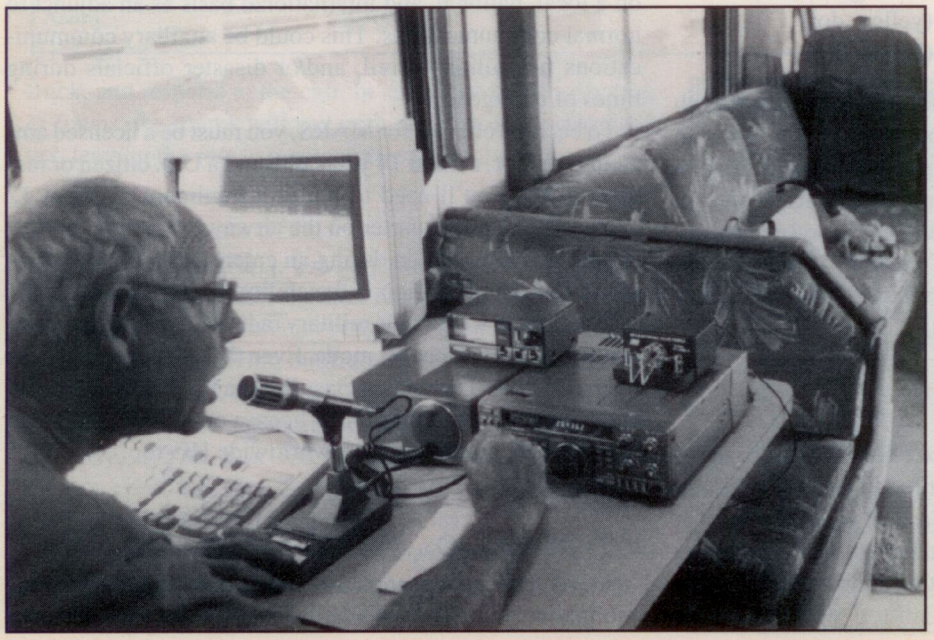
Business band radios keep this rescue team in contact with their base station. (Photo by Gordon West.)

non-profit organizations like REACT that offer citizen-oriented training courses. These may allow their members to complete an 11-week citizen's-police academy, such as REACT Team #4784 of Lake Washington in Washington State. REACT is best known for its thousands of trained volunteers who monitor Citizens Band Channel 9 and work closely with the General Mobile Radio Service (GMRS) UHF channels for emergency and travelers' assistance.

With inexpensive portable CB radios you can take advantage of any of the 40 CB channels to develop a neighborhood emergency response program. Channel 9 is the FCC-designated emergency channel. "Our community is served by Citizens Band radio 'block operations' where once a week we all come up on a specific CB channel to test for emergency preparedness," comments Dale Hanover, a CB radio operator in New Jersey. "Every single block in our community participates, so when disaster should strike, we are all tied in together over the air on portable and emergency-powered mobile CB radio sets," adds Hanover.

UHF GMRS handheld and mobile radios tie in specific block grids to a designated operator at the local community's emergency operations center in the basement of its police department. This allows CB to play an important part in damage assessment and lets public safety officials disseminate information over CB airwaves where everyone can tune in to what's happening locally and not panic.

REACT membership is strongly advised, and most REACT teams have REACT insurance to back up their emergency CB radio operation. (For more information about REACT and its national and regional conferences, write REACT Inter-



Portable worldwide station setup in a Red Cross emergency vehicle. (Photo by Gordon West.)

national, Inc., PO Box 998, Wichita, Kansas 67201.)

The best part of Citizens Band 27-MHz communications is the sheer number of operators on the air and the capability of a "party line" type of emergency communications to find out who needs help, and where. The GMRS UHF FM band is ideal for point-to-point communications where you might need up to 50 miles range from a block captain to an emergency operation center, the GMRS link acting as the filter for all of the messages coming in on regular 27-MHz CB channels from area block coordinators. And, since no license is required to own and operate a CB station, citizen block communications is a natural. Licensing is relatively easy for obtaining a GMRS permit, and there is no theory test or code test required for GMRS licensing. (Refer to "So You Want to Get on the Air" in this issue or to Gordon West's mobile communications handbook, Radio Shack #62-100.)

Once you have joined REACT International, attend a meeting at the local REACT level in your community. Ask about public service communications between your community and police department over CB and GMRS.

Business Radio at Hand

Business band portable and mobile radios operating on itinerant frequencies might also be used in an emergency (see the "Frequency Spotlight" under "Scanning Tips" for more about itinerant frequencies). During the recent Oklahoma bomb disaster, itinerant business band frequency 151.625 MHz was in heavy use between a disaster coordination center and relief agencies volunteering disaster relief supplies to an area distribution center. Both VHF and UHF FM equipment is readily available for use on itinerant frequencies that might be pressed into service for local emergency communications, such as the following itinerant and common low power business frequencies:

151.625 MHz itinerant channel (red dot)
154.570 MHz business channel (blue dot)
154.600 MHz business channel (green dot)
464.500 itinerant channel (yellow dot)
464.550 itinerant channel (brown dot)

The "dot" refers to a little color dot that corresponds with a specific channel of operation. This allows radio users to quickly see what channel their common handheld may be operating on. During emergency communications where you need to communicate from one handheld to another, always make sure to operate with your Continuous Tone Coded Squelch System (CTCSS) tone turned off. This way you'll hear everyone else on your channel.

Helping Hams

Amateur radio equipment is an excellent choice for those radio operators who will spend the time to pass the required FCC license exams. (Again, see "So You Want To Get On The Air" for information about licensing.) Amateur radio communications may be carried out on simplex frequencies over short range, or through mountain-top repeaters for far greater coverage. Most repeaters are backed up with emergency power, and ham radio operators pride themselves on being able to stay on the air after any type of hurricane, fire, earthquake, or other disaster. You'll find most repeater systems do stay on the air when emergency communicators may need them most.

Almost all cities will sponsor a civil defense program called RACES, an acronym for the Radio Amateur Civil Emergency Service. This radio service is for licensed amateur operators for civil defense communications during periods of local, regional, or national civil emergencies.

You can join this service by contacting your local city RACES coordinator, who is a representative of your county or state RACES system. Your background will be checked and your qualifications double checked to ensure that you hold the right license for the RACES program. You'll be issued an official ID card and will be asked to participate a minimum of one hour almost every week to stay up to date on emergency radio protocol, procedures, and your "standing orders" in case of a disaster. It usually takes a major disaster for RACES members to be pulled into action. But when you are called, you will see plenty of action on the airwaves!

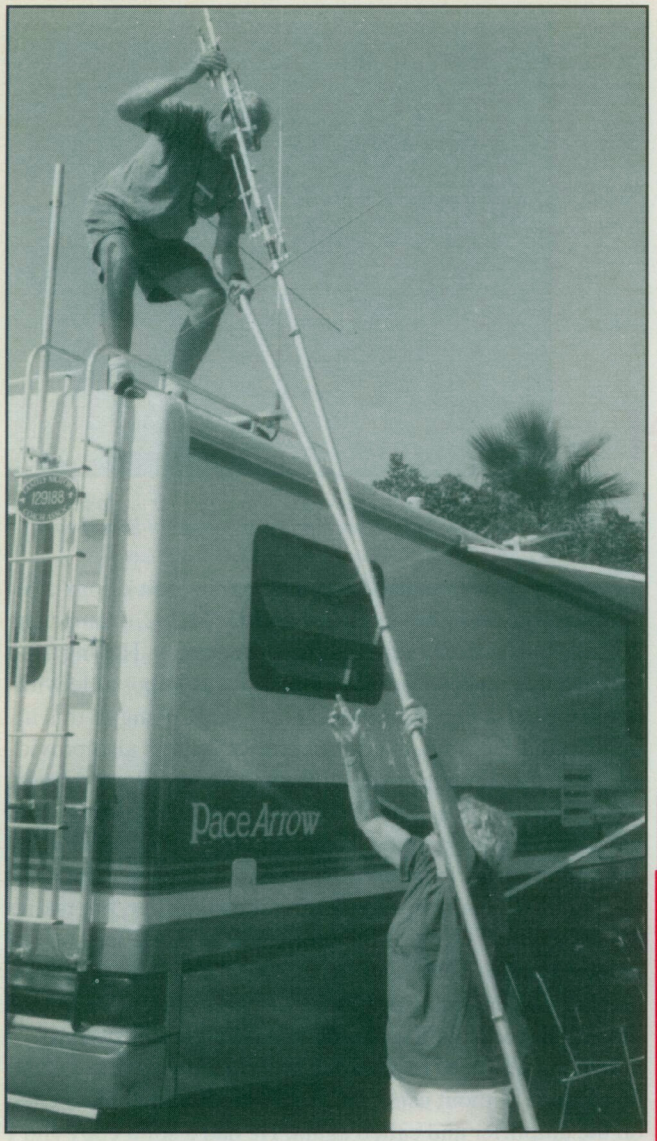
You might also join an amateur radio organization called the Amateur Radio Emergency Service (ARES), an umbrella organization similar to RACES but sponsored specifically by the American Radio Relay League (Newington, Connecticut). ARRL membership is not required to become an active member of your local ARES unit. New rules now make it possible for ARES and RACES operators to use common frequencies, so many RACES members are also members of a local ARES group.

Another exciting amateur radio public service communications group is the Military Affiliate Radio Service (MARS). MARS is sponsored by the Department of Defense and is organized as separately managed and operated programs by the Army, Navy, and Air Force. MARS operators provide Department of Defense emergency communications on a local, national, and international basis as an adjunct to normal communications. This could be auxiliary communications for military, civil, and/or disaster officials during times of emergency.

To become eligible for MARS, you must be a licensed amateur operator, at least 14 years old, and a U.S. citizen or resident alien. You'll need to put in a minimum of about 12 hours per calendar quarter on the airwaves, training on how to conduct your station during an emergency. One big benefit of MARS affiliation is the ability to operate on specifically assigned worldwide military radio frequencies in voice, teletype, CW, and packet mode. Even though you might only hold a no-code Technician class license for VHF/UHF operation, an amateur radio MARS license could also allow you onto military frequencies on worldwide HF, too.

What to Do...What *Not* to Do

As an emergency communicator, make sure that your equipment can operate for at least five days on your own



Ham operators set up for worldwide communications at a public service rally. (Photo by Gordon West.)

emergency power source. On handheld radios, these could be alkaline batteries or NiCds rechargeable from a small solar cell charter. Solar cells could also maintain a mobile battery source of power, too.

Your antenna systems must be field deployable so you can set up almost anywhere and be on the air within minutes. A mobile CB radio station in your vehicle is more than adequate, but make sure that your vehicle can get out of the garage after a major disaster! Portable equipment is always advised.

Most important, your two-way radio equipment is only as good as the operator behind the microphone. Join a local emergency communications group. Stay active on the air for at least one hour per week using your portable equipment for emergency tests and drills.

You should stay *away* from using spare marine radio or aeronautical radio handheld equipment at a disaster scene. Just because the equipment is relatively common does not necessarily mean that it's a wise choice for emergency communications. During the aftermath of the recent hurricanes in Florida, United States Coast Guard units were troubled by interference coming from marine radio users operating handhelds on shore for unit-to-unit communications. This causes congestion to authorized users, so stay off of marine channels unless you're authorized to use them on the water for ship-to-ship and ship-to-shore communications. The same goes for aeronautical channels—even though aviation radios are readily available, do *not* use them for land-based emergency communications.

An Invitation to Involvement

Why not check with your local city disaster preparedness officials and see what type of program they have in place? Who knows, your local city or community might be looking for an emergency preparedness program where you can get involved and help train other volunteer citizens how to be "radio-active" if the next disaster should wipe out conventional land-line and cellular communication systems. Volunteers like yourself can make a big difference—by making a community emergency communications system work over two-way radio. ■

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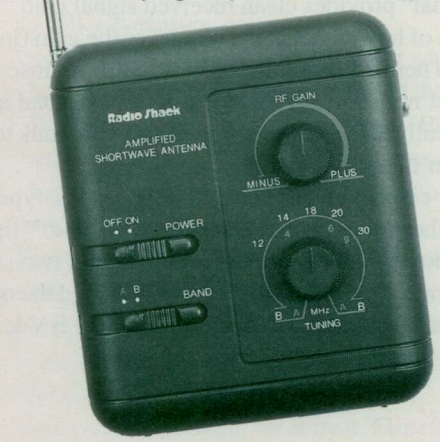
Amplified antenna packs a punch!

Shortwave fans—hear more stations, more clearly! This compact, 9V battery-powered antenna amplifies signals up to 20 dB for reception that rivals outdoor longwires. Its tunable preselector *peaks* your selected frequencies and *rejects* unwanted ones, dramatically improving reception of weak signals and giving already-strong stations crystal clarity! Plugs into radio's external antenna jack, tunes 4-30 MHz. With 29" telescoping whip. Just $29.99—great value!



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In Review: The HTA-20 VHF 2-Meter Power Amplifier

By Harold Ort, N2RLL

The Radio Shack HTA-20 power amplifier is ideal for use with the Radio Shack HTX-202 amateur transceiver.

Sometimes you've just gotta have some punch! The Radio Shack HTA-20, a 2-meter power amplifier (#19-1122), is just what you need. It'll boost the power output of your 2-meter handheld rig up to 30 watts (with 5 watts input).

Weighing in at only 1 3/4 pounds and just a little larger than a small AM/FM cassette player (1 1/2" X 3 7/8" X 6 7/8"), it's a great companion to the popular HTX-202, Radio Shack's 2-meter handheld transceiver.

The Basic Features

The HTA-20 amplifier works with 0.5 to 5 watts input, with output power up to 30 watts. It incorporates a double-tuned helical band pass filter to reduce out-of-band-interference. A what? Forget the technical stuff, the HTA-20 does a super job of attenuating frequencies you don't want to hear. This is especially important in RF-congested areas—big cities, etc.—where there's a saturation of radio signals.

While the manual mentions the low noise GaAs FET pre-amplifier that "provides clean received signal gain," there's no mention of how much gain. Whatever the gain (in dB) is, it's great! There's just enough gain to pull in those weaker stations, yet not so much to cause signal overload and distortion. It really helps, because you simply can't talk to someone you can't hear!

The only control on the unit is the red rocker-type power switch on the front panel. There's a red "power" light and green "tx" light. The back of the amplifier has two standard SO-239 connectors: one for antenna output and the other for your transmitter's input. It's powered from 13.8 Vdc. An in-line 8-amp fuse protects the unit.

Operation

I first tried this amplifier at my base station using the HTX-202 and an omnidirectional roof-mounted antenna. Using a power supply that provides up to 16 amps (you only need a good power supply that provides more than 4 amps to operate this amplifier), I carefully wired the power leads to the power supply terminals. After making the quick coax connections between the amplifier and HTX-202, I tuned the 202 to a fairly distant repeater input frequency. Having tried to reach this repeater before, I knew it was impossible without some extra punch or a yagi antenna. Kicking in this little amp did the trick—and the receive preamp also provided the extra signal to make listening easier. Signal reports from hams on that repeater mentioned "solid signal" and good audio with no noise. That's what a ham wants to hear!

From my base location it was easy to reach several ordinarily out-of-reach repeaters using the amplifier, but taking the HTA-20 amplifier on the road would be the true test of its performance. The unit comes with a mobile mounting bracket and mounting knobs for easy installation under the dash, and works with a 12-volt negative ground system.

Driving about 20 or so miles away, I called a fellow ham on simplex without using the amplifier. Nothing. I switched on the amplifier and called again. He had a solid copy and I could hear him, too, for a change.

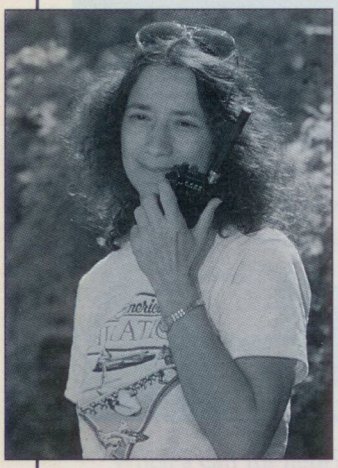
The Bottom Line

There will always be those times when your signal isn't solid into a repeater or when you want to ensure that you can be copied on simplex, especially when operating mobile. For these times, the HTA-20 amplifier is the answer. What I especially like about this amplifier is not having to worry about overloading it if my HT is on high power. As I mentioned earlier, it takes 0.5 to 5 watts input. Testing it with the HTX-202 and my base power supply, it used 3 amps (HTX-202 low power setting) and 4 amps on high. Actual power output was 22 watts and 32 watts, respectively, with the amplifier in line. But "off" there was no noticeable change in my SWR: 1.5:1 at 146.0 MHz.

Personally, I'd prefer to have a switchable preamp because there are those times when you simply don't need the preamp, but do need the extra watts. This isn't a drawback, however, as the unit performed very well in all kinds of situations, both base and mobile. ■

One Size Fits All!

Amateur Radio



If you want to get in on the fun and excitement of personal radio communications—from talking to friends across town, to making new friends in dozens of foreign countries—Amateur Radio is for you!

More than two million people around the world share a fascination with the diversity and friendships Amateur Radio brings to their lives. Amateur Radio is a multifaceted method of communication that fits every lifestyle.

Who are these Amateur Radio enthusiasts? Kings, country western singing stars, senior citizens, astronauts, school children, mechanics and homemakers, to name just a few. Anyone can enjoy Amateur Radio, regardless of age, gender, occupation or physical ability.

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Easy Radio Installation Tips

Nervous about installing that first radio in your vehicle? It's easy if you plan ahead and follow WB6NOA's tips.

By Gordon West, WB6NOA

It's not difficult to install mobile scanners, 2-meter mobile ham radios, and CB radios in your vehicle. Good wiring techniques could allow you to run this equipment off of your voltage distribution panel without the need of running wires all the way to your battery.

But before you install your two-way radio or mobile scanner in your vehicle, double check with local laws to ensure that operation of mobile equipment in your state is legal. CB radios and ham radios are perfectly okay, but some states may prohibit programmable scanners. Check it out before you bolt it in!

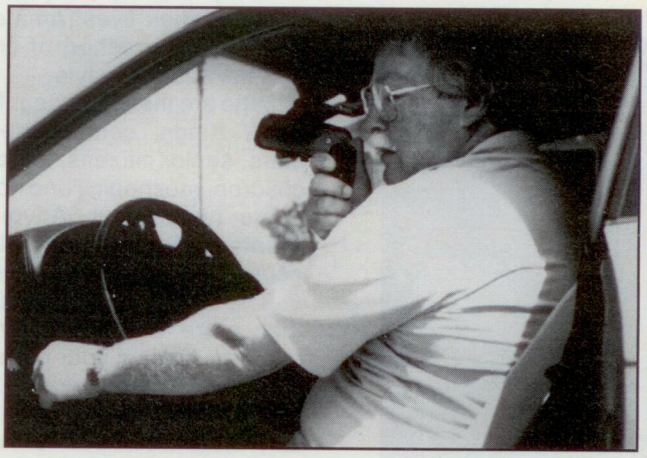
Safety First

The safe operation of your vehicle is the most important consideration when deciding where to mount that mobile unit. Don't mount it so low that you must take your eyes off of the roadway ahead to see the channel display. Yet don't mount the unit up on the dash where it might obstruct your view ahead. And don't mount it in an area where it could interfere with an air bag or pose a head-bang problem when passengers get in and out of the vehicle. Look around to find a safe place to mount the mobile unit.

Your mobile unit comes with a universal mounting bracket. It's a straight-forward installation, just double check that you're not screwing into other wiring behind the mounting structure that will support the bracket. Make sure you don't screw into anything that could interfere with the operation of your vehicle. Safety first! Convenience second.

Electrically Connecting Your New Rig

Once your equipment is safely mounted in place, you'll need to route the red and black power wires over to the fuse-panel assembly. You may need to break out your vehicle owner's manual to see where this panel is hidden. A four-foot fused DC cable set is available from all Radio Shacks and is pre-wired with polarized plug and jack. This allows power to be taken right off of a fuse that is already in place



The two-way radio should be installed to be within easy reach of the driver. (Photo by Gordon West.)

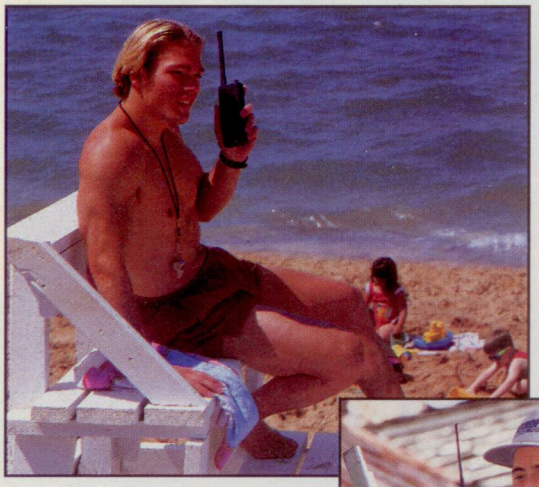
in your vehicle. Make sure your equipment draws no more current than the vehicle fuse is rated for with the other device on that fuse also turned on. I usually go to the cigarette lighter plug which is typically fused with more than enough capabilities to also handle a two-way radio or a scanner.

Double check that your circuit remains "hot" with the key turned off. This will let you use your radio to call for help in case your vehicle is disabled and your key is out of the ignition. With your radio equipment turned off, there will be no current consumption from your two-way radio or scanner other than a micro-amp or two for internal battery back-up.

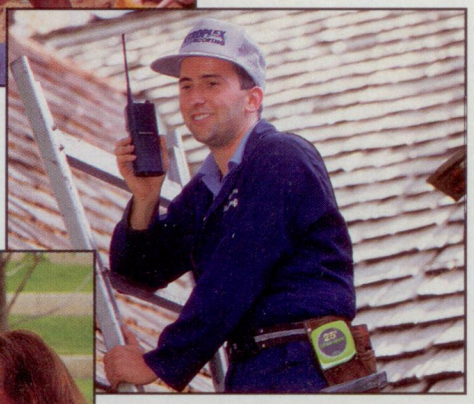
As long as you do not exceed 10 amps of current pull from your two-way radio or scanner equipment, you can go with the vehicle wiring at the fuse panel as a voltage source. However, if you're running several radio sets or have a world-wide ham set that might draw up to 20 amps, you would definitely want to go with a more elaborate installation. This would entail running very heavy red and black wires all the way up to your battery with individual fuses right on each battery terminal.

As you are wiring up your 12-volt circuit, I would suggest a noise filter choke to suppress alternator and ignition noise.

Radios for the business at hand



Recreation areas, schools, camps and churches



Construction sites and warehouses

Clinics and nursing institutions

RadioShack's new VHF and UHF-FM business-band radios are the affordable way for organizations to enjoy clear two-way communications with a range of up to several miles. Each compact transceiver features precise PLL synthesized tuning so no crystals are ever needed. And each includes a rechargeable Ni-Cd battery and charger for up to 13 hours of use between charges.

Because these radios give you benefits exclusive to the business bands, an FCC license is required. There's no exam—just a simple application and a small fee. And businesses and organizations with as few as two employees can qualify.

Affordable, reliable and built to last, these radios are designed by Motorola for RadioShack—names that mean business when it comes to radio. Discover how your organization can enjoy the benefits of business-band communications. Visit your nearby RadioShack today.

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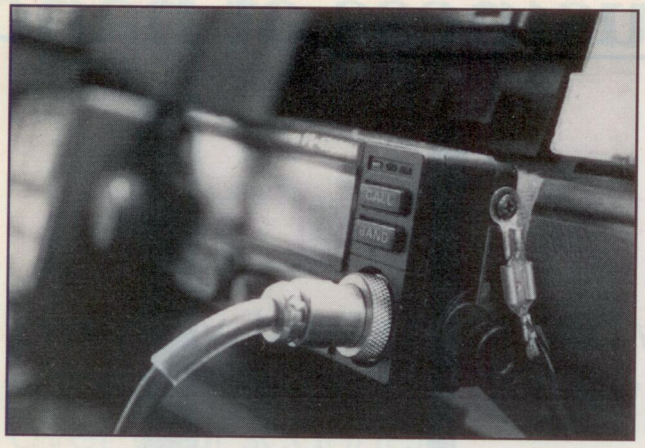
You've got questions. We've got answers.℠



Always ground the control heads to a vehicle metal chassis. (Photo by Gordon West.)

Fellow hobbyists will be happy to help you troubleshoot your antenna installation. (Photo by Gordon West.)

These are normally placed in series with the red lead and are grounded to the vehicle chassis for best power line noise elimination. These filters will minimize alternator "sing" and provide you with smooth DC so you can enjoy your radio system without alternator whine.

Turn on your equipment and see if it lights up—it probably will. Turn it off and get ready for the antenna circuit.

Now, the Antenna

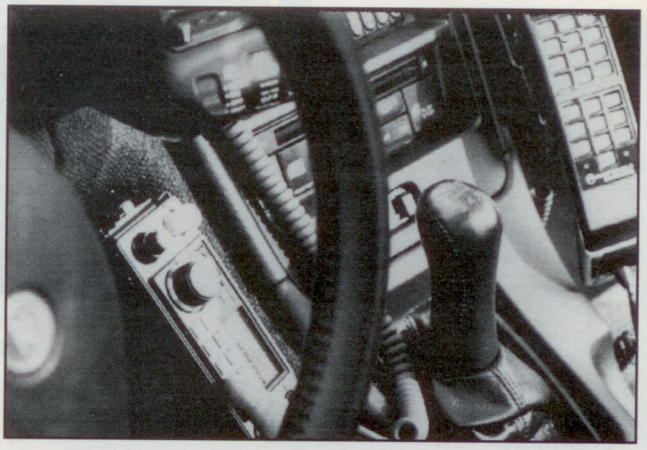
Your two-way mobile radio equipment will use its own antenna system that is specifically tuned to the band of operation. For scanners, it might be a multiple-band antenna with a loading coil in the center. For CB radio, the antenna will most likely be base-loaded, with a stainless steel stinger. For 2-meter ham, the antenna could be as short as an 18-inch whip, or, for dual-band ham, a dual-band center-loaded antenna.

Most antenna systems do not require you to bore a hole in your vehicle. A no-hole trunk mount is an ideal way to get your antenna system out in the open, away from the engine, and securely fastened on your vehicle. Mirror mounts are available for trucks and buses. Just make sure to get that antenna in the clear for best reception.

For trunk-lip mounts, the antenna cable must be threaded in through the rear compartment and over to your radio. Make absolutely sure there are no cables near your gas pedal or brake. Keep this area clear of any dangling wires, nor should you run any wires under carpets. You don't want anything to interfere with your vehicle's operation!

For scanners, you can sometimes obtain relatively good performance from a splitter that goes in between your existing automobile AM/FM antenna and your automobile radio. These work relatively well, but a separate scanner antenna will work infinitely better! Go with an outside scanner antenna, in the clear, and enjoy!

After your antenna system is all set, hook everything up, and turn on your radio equipment. Tune around and see what you hear. If it's a two-way radio, try to make some local contacts. Once you have judged the performance of your system with the engine turned off, now turn the engine on. The noise



This is one way to install a two-way business radio and cellphone on the sides of console. (Photo by Gordon West.)

level should come up a little, but not a lot. If you find that the noise level from your engine compartment wipes out all reception completely, reevaluate your antenna position and consider additional noise-elimination filters on specific engine components. These are usually recommended by your automobile mechanic.

Steady carrier "lock ups" on your scanner with the engine running are probably caused by computer noise coming from the instrument cluster on your dashboard. There are usually not too many noise spikes, but you usually have to live with them because all vehicle instrument clusters put out "dead carriers" which are rich with harmonics on specific frequencies. Every vehicle is a little different, too. Don't hesitate to contact your vehicle's manufacturer, though, for any assistance they might be able to give.

The entire installation process is easily accomplished with common tools found at the work bench. You probably won't need to solder a thing. If you follow the mounting instructions in the mobile installation manual of the equipment you've purchased, you should be all set for thousands of miles of radio enjoyment. ■

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DX-390 digital-tuning radio with 45-station memory and BFO for SSB and CW (code) reception

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WORLD BEAT

Shortwave Antennas For Clever Listeners

Get a big bang from your shortwave receiver. It's easy, and you'll practice counting, too.

By Bill Price, N3AVY

Runners stretch their muscles before running, so I have conducted an experiment in hopes of stretching my brain before writing this article. It must have worked, because my favorite hat no longer fits. The experiment deals with *antennas*—because without 'em, shortwave radios are just paperweights.

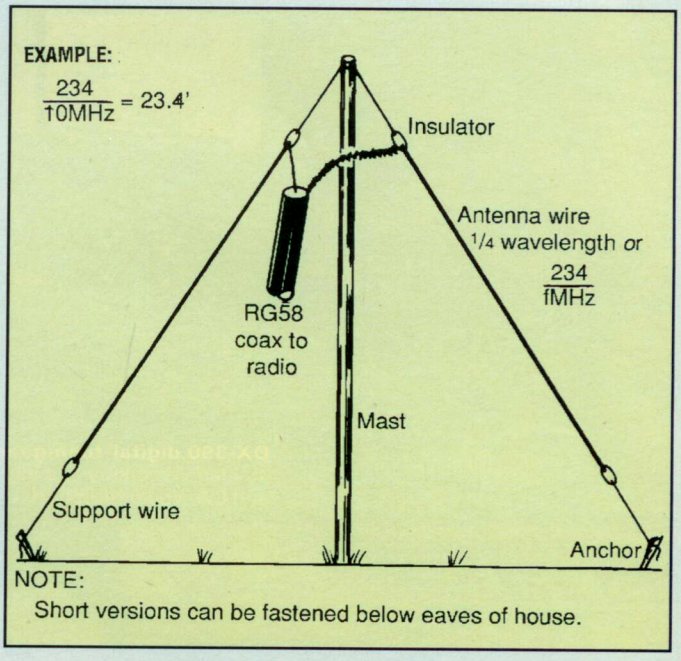
The Judges

I have three shortwave receivers on my desk: a $900 "professional communications receiver," my 10-year-old DX-440 from Radio Shack, and a $20 shirt-pocket "no-name cheapo," which is actually an acceptable little receiver if you don't mind guessing at frequencies. My most-used receiver is the DX-440, which sits next to my bed with its telescoping antenna and ferrite loop. My $20 *cheapo* also has a ferrite loop and telescoping whip, but the $900 professional receiver does not. Go figure. If you're shopping, Radio Shack's DX-390, today's version of my DX-440, gets my "best-buy" rating at just over $200. Now, on to the experiment!

Phase One—Zero to Two Feet

I first tested the $20 receiver with its two-foot telescoping antenna fully extended. It covers only about a third of the frequency range of the two better receivers, but I was able to tune 32 intelligible stations over its limited shortwave bands. With the antenna collapsed and folded, I was able to receive only six.

I move now to the $900 receiver, which has an antenna jack on the back panel, and no built-in antennas at all. Over the receiver's silky-smooth tuning range of almost 30 MHz, I was able to tune exactly *zero* intelligible stations without an antenna—*none!* With a two-foot telescoping antenna attached, I was able to tune nearly 170 intelligible stations, compared to 32 for the $20 receiver (but remember that the $900 receiver covers almost three times the frequency range of the little receiver, which means that it really performed about twice as well as the little receiver). I removed the telescoping antenna from the DX-440 and it, too, received no shortwave stations. When I reattached the antenna, the DX-440 matched the big receiver "station for station" with its whip extended to two feet, and it also has silky-smooth tuning. Perhaps price isn't everything.

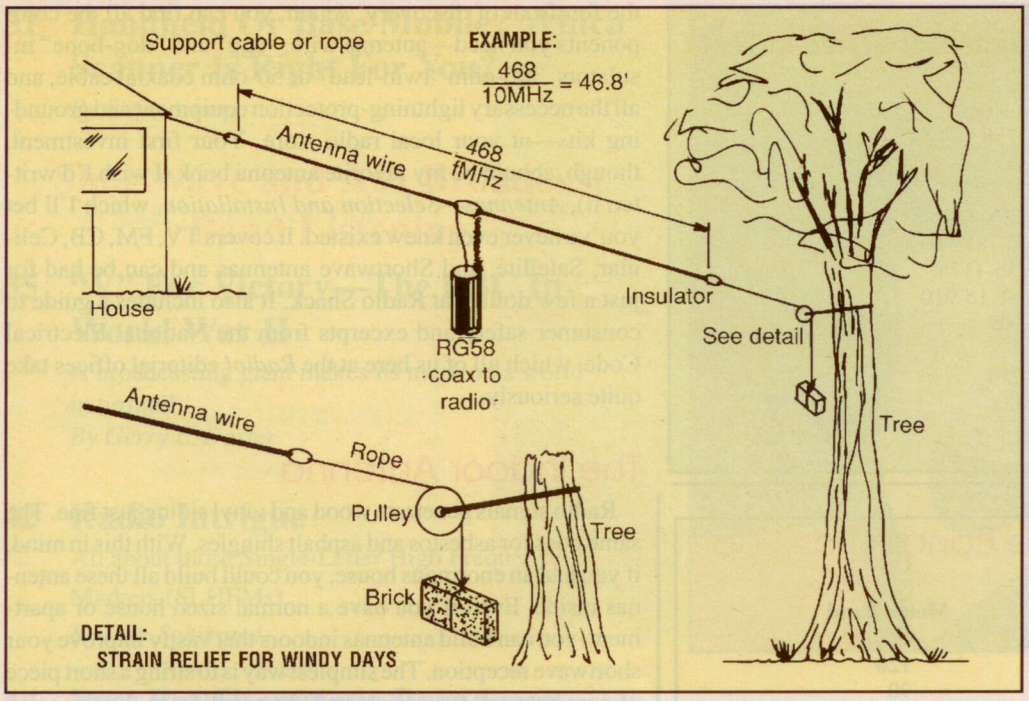


An inverted V antenna. The leads from RG58 should be as short as possible. (The formula example is for 10 MHz.)

So far we're starting to amass evidence that with shortwave radios, *more antenna equals more signals!* But let's keep going.

Phase Two—A Pair of 50-Footers

With a 50-foot outdoor wire about 10 feet off the ground, the $20 receiver did so well I stopped counting at 100 sta-



A dipole antenna with detail showing strain relief system. (Again, the formula example is for 10 MHz.)

tions. Next I connected that same antenna to the $900 radio. With this configuration I also quit counting after I'd tuned a hundred intelligible signals, but I tuned that many in only half the frequency range I used on the little radio, so it's probably fair to say that the $900 radio again outperformed the $20 radio by about two to one. Once again, the DX-440 kept pace with the $900 radio.

Raising the height of longwire antennas has a considerable effect on their performance as well, but I was limited in my ability to experiment with its height. Luckily, however, in addition to my 10-foot high antenna I have another about 40 feet up. The higher one gave me about 30 percent more and *stronger* signals.

So lets review:

1. No antenna: no signals.
2. Some antenna: some signals.
3. Bigger antenna: more signals. Clearer, too.
4. Higher antenna: even more signals. Clearer still.

When you're listening to a very strong signal, doubling the size or height of your antenna will probably make no difference. Where it makes a difference is with *weak* signals, and the wonderful part of playing with antenna size, height, and design is when you connect that new antenna and discover a signal that wasn't there just a minute ago.

If I Own a Hundred Acres, Should I String a 10,000-Foot Antenna?

Yes and no. It would work fine, but there are more efficient antennas you can build other than mere "enormous pieces of wire." You could build a dipole, which is a two-part wire antenna that can be designed for any frequency band (see diagram for a simple formula), and gives far superior performance over a random length of wire. Because of its electrical characteristics, you'd need a different dipole for each band you want to hear, unless you build or buy a "multi-band" antenna. Also, dipoles are *directional,* meaning they favor signals hitting them broadside, and do not receive very well off their ends.

A variation of the dipole is the "inverted V," which is really just a dipole with the center raised and ends lowered (also shown in the diagram). Your local Radio Shack has a multi-band inverted V, ready to install for the price of dinner-for-two. Even though I have all the books about designing and building my own inverted V, I yielded to convenience and bought mine—it's hard to beat and in most cases outperforms both my longwire antennas by a good 50 percent, even though the highest part of the V is only about 25 feet up.

If you want to experiment, please do. The best antenna hasn't been invented yet, and hobbyists have always been at

Be Smart, Stay Safe

While writing this, I received a visit from two gentlemen wearing suits and claiming to be from "the government." They heard I was writing about antennas and asked me to pass along several volumes of warnings about height and electricity. I told them I'd condense the information as best I could:

Roofs and trees are usually high, particularly if you are not as young as you used to be. Roofs get steeper as you get older and trees become harder to climb. If you have any doubts about whether you're up to climbing either one, listen to them—they're probably right. Seek youthful, competent help.

All utility wires conduct electricity; otherwise, the utility companies would save money by using rope. It's unlikely that you know which ones are more dangerous than others, so stay away from all of them. And *never* install an antenna where it could fall and touch a utility line.

People who think they are an exception to safety rules are in the most danger.

Radio Shack Products Mentioned In Text

Portable Shortwave Antenna, 278-1374
SW Antenna Kit, 278-758
Antenna Wire, 278-1329
Mini-Egg Insulators, 278-1335
"Dogbone" Insulator, 278-1336
Inverted V Antenna, 20-181
300-Ohm Twin-Lead, 15-1175
Antenna Discharge Unit, 15-910
Grounding Block, 15-909
Ground Rod, 15-529
DX 390 Receiver, 20-214
Antenna Book, 62-1083a

The Shortwave Bands Close-Up

Frequency Range (MHz)	Meter Band
2.3– 2.495	120
3.2–3.4	90
3.9–4.0	75
4.75– 5.06	60
5.9–6.2	49
7.1–7.35	41
9.4–9.9	31
11.6–12.1	25
13.57–13.87	22
15.1–15.8	19
17.48–17.9	16
18.9–19.02	15
21.45–21.75	13
25.6–26.1	11

Amateur Radio Bands

Frequency Range (MHz)	Meter Band
1.8–2.0	160
3.5–4.0	80
7.0–7.3	40
10.1–10.15	30
14.0–14.35	20
18.068–18.168	17
21.0–21.450	15
24.890–24.990	12
28.0–29.7	10

Note: Frequencies outside of the bands assigned to the broadcasting and amateur radio (and sometimes within them) are used by a wide variety of stations: fixed communications stations, maritime and aeronautical, U.S. and foreign military communications, U.S. and foreign government, standard time, so-called "spy" broadcasts, VOLMET aviation weather reports, shortwave broadcast feeder stations, unlicensed "pirate" broadcasters and more. Transmissions may be in voice (AM or single-sideband), Morse code, various forms of radioteletype, or facsimile or more esoteric forms of modulation.

the forefront of discovery. Again, you can find all the components you need—antenna wire, "egg" and "dog-bone" insulators, 300-ohm "twin-lead" or 50-ohm coaxial cable, and all the necessary lightning-protection equipment and grounding kits—at your local radio store. Your first investment, though, should be my favorite antenna book (I wish I'd written it), *Antennas—Selection and Installation,* which I'll bet you've never even knew existed. It covers TV, FM, CB, Cellular, Satellite, and Shortwave antennas and can be had for just a few dollars at Radio Shack. It also includes a guide to consumer safety and excerpts from the National Electrical Code, which all of us here at the *Radio!* editorial offices take quite seriously.

The Indoor Antenna

Radio signals penetrate wood and vinyl siding just fine. The same goes for asbestos and asphalt shingles. With this in mind, if you had an enormous house, you could build all these antennas inside. Even if you have a normal sized house or apartment, you can build antennas indoors that vastly improve your shortwave reception. The simplest way is to string a short piece of wire between two points and use an alligator clip to secure one end to your radio's telescoping antenna (or a plug if your radio has a jack). If you're a listener and not a builder, your local radio store has a wonderful little portable shortwave antenna that winds up in it's own storage case. One end clips to your radio and the other attaches nicely to those brand new draperies or to the lapel of someone standing very still. Most window screens make good temporary antennas, as do storm window frames, sliding door frames, and storm or screen doors. The old fingerstop on dial-type telephones (remember them?) was an excellent antenna, but, alas, it has no counterpart on new pushbutton phones.

You can permanently install larger, more elaborate wire antennas inside your attic where they'll never be bothered by wind and weather, and the only climbing you'll do is up the stairs.

Be creative and compare your before and after performance to see how your antenna installation performs. Have fun, stay safe, and join us next time.

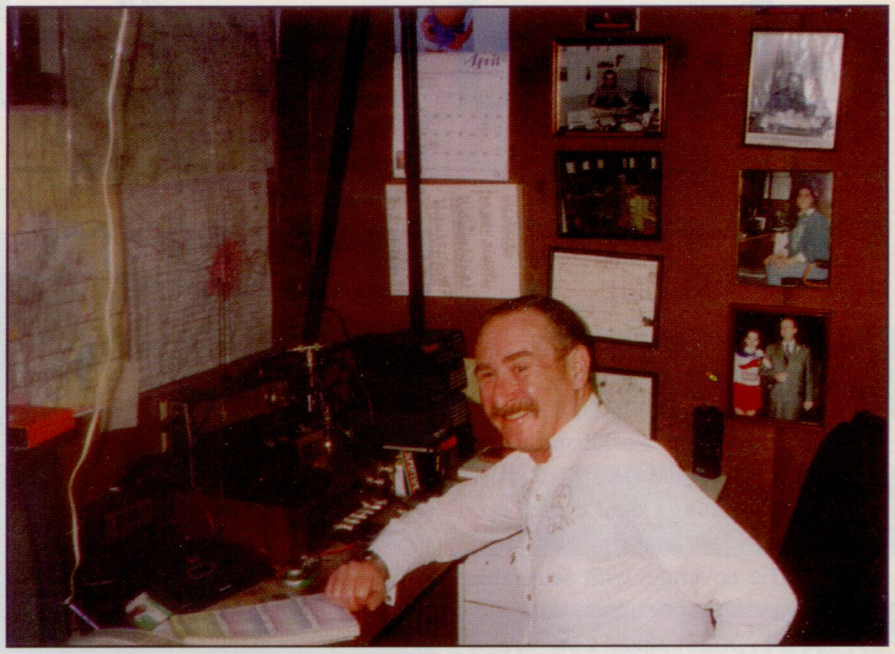
To those who would brandish their hard-earned electrical engineering credits at me, I acknowledge that there are exceptions to my statement that "more antenna equals more signals," and that some well-loaded, well-tuned, or well-oriented antennas can outperform some larger or longer antennas. Most shortwave listeners, however, would simply like to receive more stations, and receive them louder and clearer than they do now. It is for those folks that I write simply and to the point, with no apologies. ■

For additional information regarding antenna design, theory, and construction, you can request a list of antenna publications from The American Radio Relay League, 225 Main Street, Newington, CT 06111.

Other publications are available from The CQ Bookstore, 76 N. Broadway, Hicksville, NY 11801.

My Radio Shack

Have a shack in your home that you're mighty proud of? Lots of Radio! *readers do. Why not send in a photograph and some information about yourself and your equipment, like Robert W. Winter of Topeka, Kansas, did. In Robert's words...*



This is my base station in Topeka, Kansas. Among the Radio Shack products shown are a PRO-50 tunable multiband radio and PRO-2006, 2030, 2032, 2033, and 2036 base scanners. These are connected to a Radio Shack roof antenna, as is a DX-390; these, an AM-FM stereo cassette player, a time and weather radio, and other Radio Shack products are not in the picture.

I got my first Realistic radio in 1965, third-hand. It was a tunable public service high-band set that gave several years of good service, despite being hit by a tornado that destroyed my college rooming house and being rained on for several hours. However, dried out and plugged in, it worked fine.

With the current rig, I receive public service and aviation transmissions from over 50 miles away. This summer, I've enjoyed "visiting" my east coast roots thanks to skip traffic from New York, Maryland, and Virginia, and have made "side trips" to Mississippi and Louisiana. I am also in the process of changing my transceiver base from Citizens Band to GMRS. ■

OUTDOORS

DX grabber! Multi-element SW antenna, only $29.99

World-band DXers: hear what you've been missing! This multiple-dipole antenna is design-optimized for outstanding reception of all international shortwave broadcast bands. No matching, no power source required—it's equivalent to over 190 feet of wire, yet just 65 feet in total length. Mounts easily on roof eaves or a single mast, and accepts a PL-259 plug so you can connect it to your receiver with low-loss coaxial cable. A terrific value—just $29.99 at your nearby RadioShack.

WE BRING YOU THE WORLD.

RadioShack℠

You've got questions. We've got answers.℠

Radio Shack Highlights

Products

The DX-394 Tabletop Shortwave Receiver (Catalog #20-224)

The DX-394 is a sensitive, selective, rock-stable receiver with features to please both novice worldband radio listeners and seasoned DXers.

Its digital-tuning, dual-conversion system provides gapless 150 kHz–29.999 MHz coverage with selectable AM, lower sideband, upper sideband, CW-(code) wide and CW-narrow modes, plus fine-tuning control for SSB/CW. Users may explore bands with the rotary tuning knob, program up to 160 frequencies for easy pushbutton recall, enter a desired frequency or band directly on the keypad, even automatically scan preset stations or search for new ones.

The DX-394 also features a lighted, multifunction LCD display, five programmable on/off times and sleep-timer auto-shutoff. It includes a detachable antenna, SO-239 (coaxial) and RCA jacks for external antenna, plus jacks for headset, external speaker, tape-out, and external DC power.

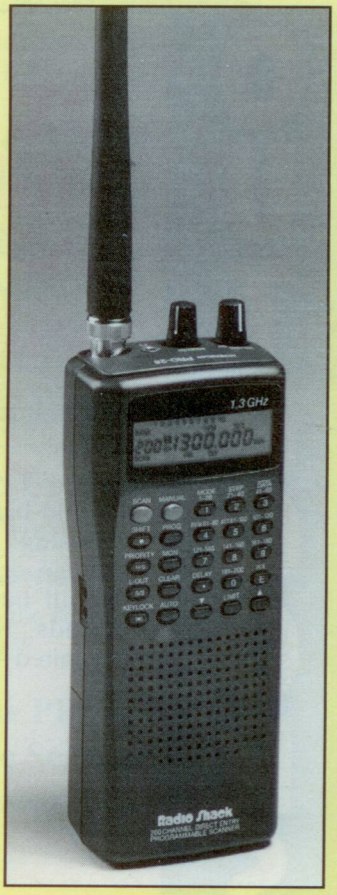
Suggested retail price: $399.99

The PRO-26 Portable 200-Channel Scanner (Catalog #20-506)

The new PRO-26 200-channel portable scanner provides coverage from 25 MHz to 1.3 GHz (excluding cellular service frequencies).

The scanner gives direct access to over 76,000 exciting frequencies used by police and fire departments, ambulance and transportation services, amateur radio, aircraft communications, Citizens Band and commercial FM and television stations.

Other features include Radio Shack's exclusive Hyperscan high-speed scanning speed for scanning through programmed channels at 50 channels per second; 10 channel-storage banks; search skip for selecting up to 50 frequencies for the scanner to skip during search; auto sort to scan stored channels in order from lowest to highest for increased speed; HyperSearch which scans at 300 steps/sec. (in 5-kHz steps only); switchable two or four-second scan delay; data skip; lockout function; automatic modulation mode, and a weather band key.



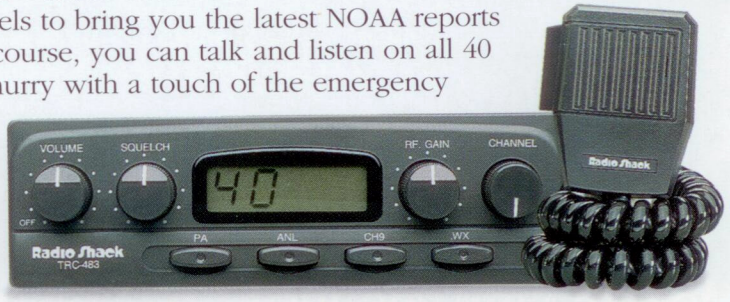
The PRO-26 can be powered by alkaline batteries, rechargeable batteries, or AC or DC power. It even recharges recharge-able batteries in the scanner.

Suggested retail price: $449.99

Don't know why there's no sun up in the sky?

With RadioShack's TRC-483 mobile CB, you can be prepared for stormy weather *before* it hits. Its built-in weather radio receives all seven U.S. and three international weather channels to bring you the latest NOAA reports and forecasts for your area, 24 hours a day. And of course, you can talk and listen on all 40 Citizens Band channels, and get highway help in a hurry with a touch of the emergency Channel 9 priority button.

You'll find driver-friendly features throughout RadioShack's fleet of affordable mobile CBs. And RadioShack is *the* source for antennas and accessories, plus helpful advice when you need it. Travel with the best—visit your nearby RadioShack today!



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"Up here, having clear communication with my partner is a must. We rely on our TRC-506 hands-free walkie-talkies to keep in touch, and they've never let us down."

RadioShack's rugged, dependable 2-way headset radios are lightweight and feature-packed! Look what's built into them:

Dual-conversion superhet receivers drastically reduce interference so speech is clear and intelligible.

49MHz FM operation is ideal for short-range (up to ¼ mile) applications. Provides clear transmission with less noise and interference than Citizens Band.

Voice-activation, with selectable sensitivity control, helps you keep your hands on what's really important.

"We're serious about our fun. No way we'll settle for gear that will leave us hanging. That's why we chose RadioShack."

The Fun Starts Here!

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